FLYING

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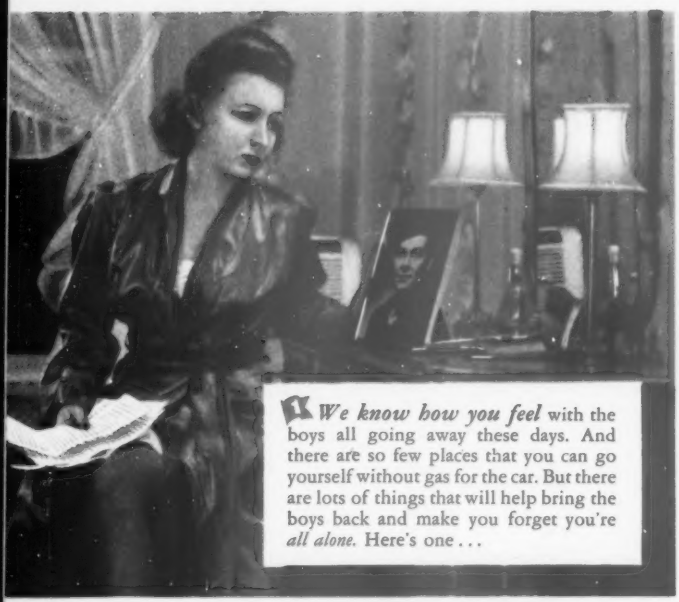
MARINE AIRMEN v GUADALCANAL

Maj. Gen. RALPH J. MITCHELL, USMC

The PRESIDENT'S FLIGHT

To a young lady who's *All Alone* these day



1 *We know how you feel* with the boys all going away these days. And there are so few places that you can go yourself without gas for the car. But there are lots of things that will help bring the boys back and make you forget you're *all alone.* Here's one . . .

2 *You can keep busy and ha*
by taking up home nursing. It's eas
learn in your own home town. Th
with doctors and nurses so busy you
be a real help in the war effort.
your local Red Cross Headquarters
Civilian Defense Office about it n

3 *There's a Silver Lining* in the war clouds. When t
war's over you'll be *going places,* on trips all over the coun
in hours instead of days, in your own Cessna Family Car
the Air. An easy afternoon's ride will take you from N
York to Cincinnati. And you'll find that flying your Cessn
as easy as driving an automobile. Today, of course, w
busy day and night building planes for Uncle Sam. But ch
up if you can't *go places* now. You'll more than make up
it after the war in your Cessna Family Car of the Air.

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Cessna

Priority Delivery by Buying War Bonds Now...
You can be one of the first to own a Cessna Family Car of the Air after the war. Orders are bound to exceed production. But you can get a preferred listing for early postwar delivery. No postwar obligation to buy. Costs you nothing. Write us today for the simple priority plan. CESSNA AIRCRAFT CO., Box 1616-FPA, Wichita, Kansas.

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If You Have a Genuine Interest In Aviation as a Career —

If You Want to Serve Your Country Best in Time of War —

Enter PARKS AIR COLLEGE!

You who can answer these statements in the affirmative will do well to consider taking up Parks Leadership Training as soon as you can qualify.

Parks is continuing its aviation training for a capacity enrollment of civilian students. It is expected that this contribution to the war effort of our country will continue.

You want, first of all, to do everything you can to aid America in these critical times — yet, if you are sincerely interested in aviation as a lifetime career, you should also look beyond the present.

The better prepared you are to accept positions of responsibility and to forge ahead to leadership, the greater your value to your country and to the future progress of aviation as well.

As a graduate of Parks, you will be equipped with a broad, thorough education. You will have acquired a grasp of the aviation industry both from the technical and the executive viewpoint — trained to make the most of your opportunities, to be of greater value in whatever fields you serve, in War or Peace.

If you are genuinely interested in receiving training which will enable you to be of the greatest value to your country as well as to the aviation industry, if you are a high school graduate and ranked in the upper two-thirds of your class, or if you are still in high school as a junior or senior, you should write at once to Parks for complete information.

The coupon below brings you the 64-page Parks Catalog with full information on each of Parks' four courses. Send a postcard request or mail this coupon today.

PARKS AIR COLLEGE was founded August 1, 1927. Has enjoyed full Federal approval longer than any other aviation school.

Is accredited in its Aeronautical Engineering School by the Illinois Superintendent of Public Instruction.

Included since 1938 in The Directory of Colleges and Universities, issued by the United States Office of Education.

Has a capacity enrollment of 300 commercial aviation students, also detachments of U. S. A. Air Forces Aviation Cadets and Mechanics.

Has its own airport with a school plant of 25 buildings devoted to school purposes entirely, also a group of fields for military flight training.

Has a faculty of 104, each especially qualified for his particular field of instruction.

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East St. Louis, Illinois

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Address.....

City..... State.....

PARKS AIR COLLEGE, East St. Louis, Ill.

FLYING

including **INDUSTRIAL AVIATION** VOLUME XXXII NUMBER 4

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TRAINING is the key to SUCCESS in

WAR PRODUCTION
U. S. AIR FORCES
FUTURE of AVIATION

Never has it been more difficult to plan your future, but the one great lesson taught us by the war is that thorough technical training is the key to success. Whether you seek an important supervisory position in aircraft production or a high technician rating in the U. S. Air Forces, you can only obtain it through long-range training that prepares you for the more responsible positions . . . and ONLY such training can fit you for a career in the tremendous expansion of civil aviation after the war.

The executives who have made aviation THEIR career know that the value of each man is governed by two factors: his intelligent sincerity in selecting aviation as his life work, and THE ABILITY AND EXPERIENCE OF THOSE WHO TRAIN HIM FOR THAT CAREER. They know that Curtiss-Wright Technical Institute graduates are—and for many years have been—thoroughly qualified to fill the industry's exacting requirements.

Located in the very center and a very important part of Southern California's great aircraft industry, with its more than two billion dollars in unfilled orders, Curtiss-Wright Tec has come to be recognized as the nation's leading institution for the training of Aeronautical Engineers and Master Mechanics. Mr. Donald Douglas, President of the great Douglas Aircraft Company, chose this school for his own son's training, which pointedly indicates the high standing Curtiss-Wright Tec has attained in the aircraft industry since its establishment in 1929.

It is imperative that before you invest in a course of career training you determine what the returns will be on your investment . . . for your training will determine how much money you will make all the rest of your life.

Curtiss-Wright Tec's career training is carefully designed to do just one thing:—TO MAKE MONEY FOR YOU, so that upon graduation you can be independent and self-supporting for life. Our thousands of successful graduates have proven that Curtiss-Wright Tec training gets results and always pays, since it trained them in advance for the highest position they could ever expect to occupy. It can do the same for you.

This school has never guaranteed positions for its graduates, but practically every graduate has obtained immediate employment and is advancing rapidly. The demand for our graduates far exceeds the supply, and we honestly believe that every student who enrolls here will be able to obtain, with our assistance, immediate employment upon graduation.

WARNING!—"Don't miss the boat." The greatest opportunity in your lifetime exists today! There never was such an opportunity in aviation for you; there may never be another. A position awaits you. Insure for yourself a steady income and independence for life. DON'T FOLLOW—LEAD! Send in your enrollment before you "miss the boat."

Offering specialized and proven training in AERONAUTICAL ENGINEERING & MASTER MECHANICS

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UNDER PERSONAL SUPERVISION OF MAJOR C. C. MOSELEY, OWNER, SINCE ITS ESTABLISHMENT IN 1929

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BE WISE—PROTECT YOUR FUTURE

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- ☐ POST GRADUATE AERONAUTICAL ENGINEERING COURSE
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- ☐ AERONAUTICAL DRAFTING COURSE, HOME STUDY
- ☐ AIRCRAFT BLUE PRINT READING COURSE, HOME STUDY

NAME _____

ADDRESS _____

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Trail Blazing in the Skies

1924

THE FIRST U.S. NAVY AIRPLANE to be built with duralumin structural members was the Martin MS-1, produced in 1924. These members were formed by Goodyear for the Glenn L. Martin Company. This important work was entrusted to Goodyear because of our previous experience in building duralumin keels for military airships — the first use of this metal-alloy by any private aircraft manufacturer in the United States.

HOW GOODYEAR AIRCRAFT CORPORATION SERVES THE AVIATION INDUSTRY

1. *By building parts to manufacturers' specifications.*
2. *By designing parts for all types of planes.*
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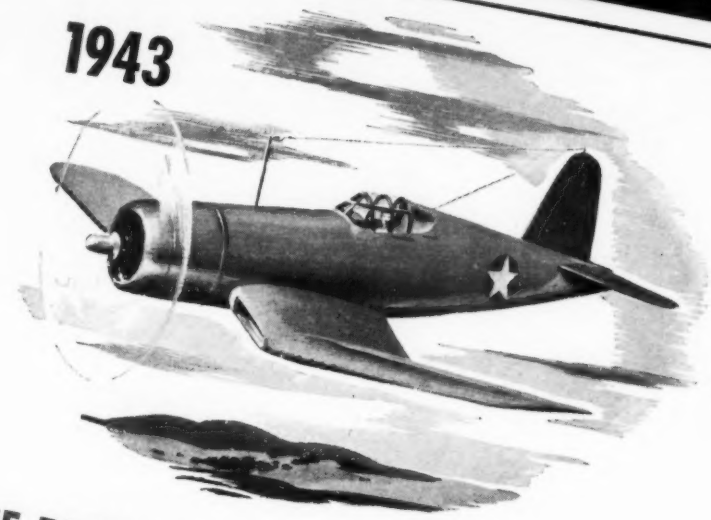
4. *By extending our research facilities to aid the solution of any design or construction problem.*

1943



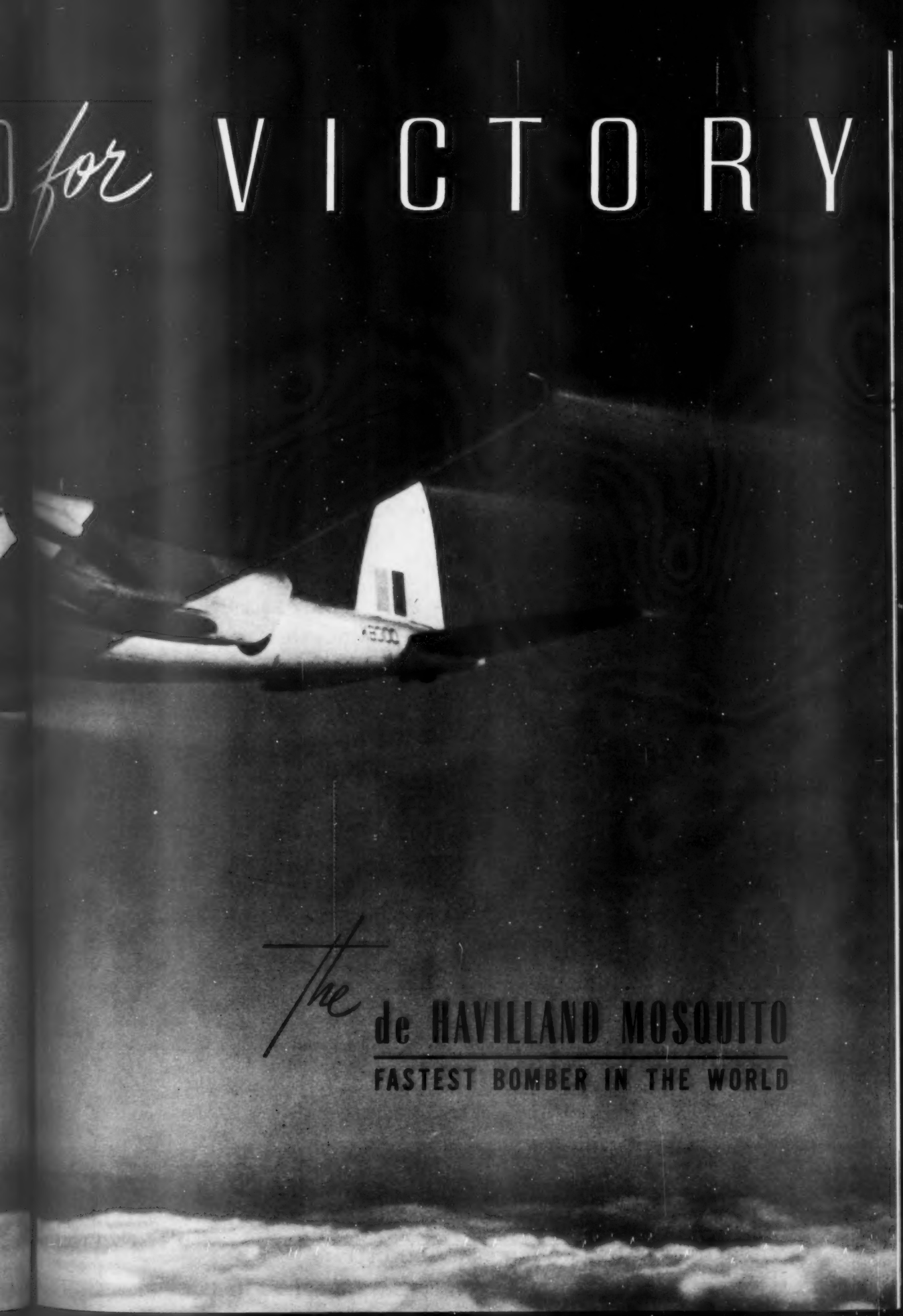
THE FASTEST NAVY AIRPLANE in service today is this Corsair fighter. This airplane is now also being built by Goodyear from specifications of the Chance Vought Division of United Aircraft Corporation, the Goodyear version being designated as the FG-1. Into the building of this all-duralumin ship goes all of Goodyear's long experience in fabricating metal aircraft structures. Although it is faster, longer-ranged and more powerfully armed than any other Navy fighter now in action, its weight is remarkably low for all that is packed in it—proof of superior design and construction.

GOODYEAR

GOODYEAR

AIRCRAFT

DESIGNED fo


for VICTORY
the de HAVILLAND MOSQUITO
FASTEST BOMBER IN THE WORLD

SALUTE TO THE ARMY

ARMY DAY — APRIL 6TH

SPARTAN SCHOOL OF AERONAUTICS

(Operated as a division of the Spartan Aircraft Company)—Spartan School graduates are serving the aviation industry in practically every capacity—as aeronautical engineers, aircraft and engine mechanics, pilots, instructors, radio and instrument technicians, meteorologists, sheet metal supervisors. Many others are out on the fighting fronts. This "University of Aviation" is regarded as the outstanding civil aviation training school in the U. S.

ON APRIL 6th the nation celebrates the 15th anniversary of ARMY DAY . . . and pays homage to the gallant legions of the United States Army at home and abroad. In war and in peace, the Army has been the faithful guardian of life and Democracy. Today, it is upholding its glorious heroic tradition in new deeds of bravery and history-making achievements.

SPARTAN salutes the Army . . . as well as all other members of America's armed forces . . . all united in the common cause. As a producer of essential war materials, SPARTAN recognizes its deep obligation to America's fighting men and pledges unceasing devotion to duty and faithfulness of purpose until victory is attained.

SPARTAN *Aircraft Co.*

TULSA, OKLAHOMA

★*Contractor to the U. S. Army and U. S. Navy*

★BUILDERS OF FINE AIRCRAFT SINCE 1929

A MUSTANG'S "KICK"

comes straight from its tires

THE NORTH AMERICAN MUSTANG is specially adept at fast, low-flying sweeps . . . destroying small, highly strategic targets. But the flashing speed that brings the Mustang safely through, really starts and ends on the ground. . . with *TIRES built to take* the terrific punishment of fast take-offs and "hot" landings!

General Airplane Tires have proved their ability to "take it" on *every* type of ship. For Generals are designed to take it . . . built by engineers on the basis of the long practical experience gained in General's *years* of airplane tire manufacture.

Yet ability to take it is but *one* superior feature of the General Airplane Tire. General is versatile! You'll see Generals on heavy bombers, on light CAP ships...on military trainers, fighters, on the decks of aircraft carriers and on private aircraft . . . *for flyers everywhere depend on Generals!*

Here's Why General Has Won the Preferred Acceptance of Those Who Fly...

1 Built to Military and CAA specifications by experienced airplane tire *engineers.*

2 General's *Rayon Cord* means less weight, greater payload. More strength, resistance to impact and heat!

3 Dangerous static electricity, built up in flight, is grounded out the moment a General touches the ground . . . thanks to General's special electro-conductive construction.

4 There's a QUALITY General for every type of ship.

5 The same skill . . . craftsmanship and highest quality standards that have always characterized *Generals* are incorporated in the General Airplane Tire.

See Your Fixed Base Operator or Write—

THE GENERAL TIRE & RUBBER COMPANY

Aviation Division • Akron, Ohio

The GENERAL AIRPLANE TIRE

KNOWN AROUND THE WORLD FOR QUALITY AND SAFETY

The Birdmen's Perch

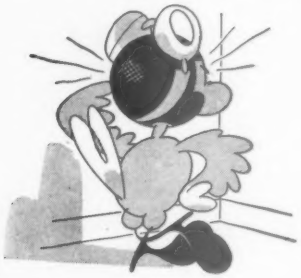
It would take 400 of the finest electrolytic graphite particles in Gulf Penetrating Oil to encircle a strand of the finest-drawn tungsten wire... and such wire is almost too fine to see!

Graphite is the best dry lubricant known to science and has an affinity for steel. So we put it in Gulf Penetrating Oil and it lubricates so efficiently that rusted nuts, bolts, pipe couplings, and other threaded connections that won't budge readily with a wrench can be freed!

We thought you Perch Pilots at the airports should know about this Gulf product.

Major Al Williams,
alias, "Tattered Wing Tips," Gulf Aviation Products Manager, Gulf Bldg., Pittsburgh, Pa.

P.S. Don't mind Flutter this month. He's sulking because he wants to be a mascot and nobody has asked him.



ZOOT SHOOT WITH A REICH STRIKE

A bomber doing 300 mph dropped a bomb on Berlin from 10,000 feet. A helicopter which was hovering motionless, dropped the same size bomb from the same altitude at the same time. John Schomburg, of Pearl River, N.Y., wants you to figure which bomb hit first, and why. He sent us the answer, too, and that's more than we can say for a lot of you Perch Pilots.

We'll send it to you if you ask.

EVER SEEN 0.00078 OF AN INCH?

Don't laugh . . . dust particles that big have chewed up more plane engines than you could shake a joystick at. Down in Africa, this dust has been found as high as 15,000 feet. It's so abrasive that planes have been abandoned over enemy territory before they'd completed a single flight, because the piston rings were worn so badly!

Captured enemy planes were found to have filters that did about half a job. Our

Allies developed filters that were better. But American engineers devised filters capable of removing 90% of the dust from the air . . . and the problem was no longer a problem.

Unstable hydrocarbons in a lubricating oil are much smaller than 0.00078 of an inch. And old-fashioned methods of refining do about half a job of removing these impurities. But Gulf's engineers devised a super-refining technique for Gulfpride, called the Alchlor Process. *The Alchlor Process is the most effective method yet developed for removing impurities and unstable hydrocarbons from oil.*

When you use Gulfpride, the lubrication problem is no longer a problem.

KEEP 'EM LYING

Sir:

Believe me, I need some Gulf Aviation Gasoline! Our peaceful little town has been taken over by an outlaw with a super-phee-nominal secret weapon. This coyote got himself cornered while robbing the bank and found himself with a jammed shooting iron. He grabbed a bottle of G.A.G. that the bookkeeper uses to clean his typewriter, and put a little in the "catridge-cylinder" of his hog-leg. Every time he pulls the trigger, the thing spouts flame, a little cyclone screams outta the barrel and wrecks everything in shooting distance.

He's sitting in the saloon now, with the only bottle of G.A.G. left in the county in one hand, his cannon in the other. We gotta have some G.A.G. quick to get this critter, then we're going over and finish that Hitler varmint!

Respectfully, Ray Stoddard, Iowa State College.

Gulf Oil Corporation and Gulf Refining Company... makers of

GULF AVIATION PRODUCTS

OIL IS AMMUNITION—USE IT WISELY!

"A REASONABLE OIL CONSUMPTION IS NECESSARY AND IS TO BE EXPECTED IN A PROPERLY—
—LUBRICATED ENGINE.... RADIALS USUALLY USE BELOW 0.030 LBS. PER HOUR AT FULL THROTTLE AND RATED POWER.
AT CRUISING OIL CONSUMPTION IS ABOUT 1/3 OF FULL POWER CONSUMPTION, AND CRUISING POWER—
—IS PLENTY, WHEN YOU USE THAT GOOD GULF AVIATION GASOLINE"
Gulf

An Achievement

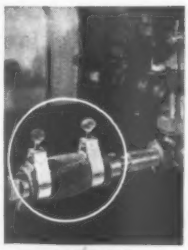
IN ENGINEERING AND DESIGN

the new

WITTEK Types FBC and FBCA Aviation Hose Clamps

Now a Hose Clamp made from mild carbon steel having performance characteristics comparable to those obtained from stainless steel construction. Wittek Types FBC and FBCA Hose Clamps are similar in design to Types FB and FBA Hose Clamps which became the standard of the Industry. . . . All materials used in Wittek Types FBC and FBCA are non-critical mild carbon steels, zinc plated to Specification AN-P-32 for corrosion resistance.

Wittek Manufacturing Co., 4305-15 West 24th Place, Chicago



Exceeds

LEAK TEST REQUIREMENTS

Illustration shows two Wittek Type FBCA Hose Clamps installed on 1-inch I.D. hose to a wrench torque of 20-inch lbs. Pressure applied inside the hose is 210 lbs. per square inch *without leakage.*

Exceeds

TORQUE WRENCH REQUIREMENTS

Illustrates Wittek Type FBCA Hose Clamp installed on hose to a wrench torque of 118 lbs. *without failure* to any parts.

Exceeds

STRENGTH REQUIREMENTS

Illustrates Wittek Type FBCA Hose Clamp being load tested without hose. Load imposed on the Clamp is 2970 lbs. *without failure*

All tests conducted as outlined in Army Specification 25529, April 16, 1942

WITTEK Aviation HOSE CLAMPS

INSPECTION
made easy
NOW vital spots beneath the covering of modern airplanes are inspected in a fraction of the time formerly required for this all-important job . . . thanks to HEATH Inspection Covers. Standard on several popular makes of ships, these Covers have eliminated the old "slash method" with its unsightly patchwork and uncertain results . . . Here again, HEATH has contributed to the convenience and safety of today's flying —and tomorrow's.
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MANUFACTURERS OF AIRCRAFT COMPONENTS
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HEATH INSPECTION COVERS are made of Plastic, Plywood, Aluminum and Steel, in several sizes and types. HEATH now produces the world's largest volume of aircraft Inspection Covers . . . Write for data.
HEATH

AT DEADLINE

by MAX KARANT

MUCH is being said these days about post-war aviation. Great plans are being conceived. Huge airline networks are to operate the length and breadth of the globe, without regard for oceans, continents, climates, and so on. Even the most hidebound reactionary is air-minded and stumbles over his brother H. R.'s while rushing forward with some new, world-shaking proposal to make aviation even greater.

However, we have yet to hear of one proposal that is simple and obvious and one which would almost surely have won the war for us before this, had something been done about it 10 (even five) years ago. That is, the capitalizing on the air-mindedness of the youth of the United States. Today, nearly any young man in one solid piece can learn to fly free of charge in the Army or Navy. He can get the finest flight and technical training on earth, and the Government will gladly pay out a small fortune to see that he does.

But no great thinker thought of that a few years ago. If he had—and had enough power to do something about it—the United States would have been overwhelmingly the most gigantic air power on earth. Not that the idea was original. The Germans, of course, not only thought of it, but did something about it. So did the Russians. The British and Canadians and Australians had their government-blessed flying clubs. But no matter what those countries did, they could not offer their air-minded youth anything like the potential that the United States wasted. We not only wasted millions of air-minded young men; we also had facilities to build almost unlimited numbers of aircraft. The whole country could easily have been studded with flying clubs . . .

Think of what that would have meant to the United States today. There could have been a million Government-trained pilots in this country when war broke out. The mere presence of so many airmen undoubtedly would have given us a larger number of military and naval planes than we had on December 7. Now, of course, both the Army and Navy are scrambling for every air-minded youth they can find. The Navy only recently started to look to the high schools. Government officials are just beginning to become aware of the fact that the bulk of the fighting men in the air forces are, by all previous standards, youngsters. Youngsters so air-minded that even the most callous of them can hardly wait to get back up in the air again on the next mission.

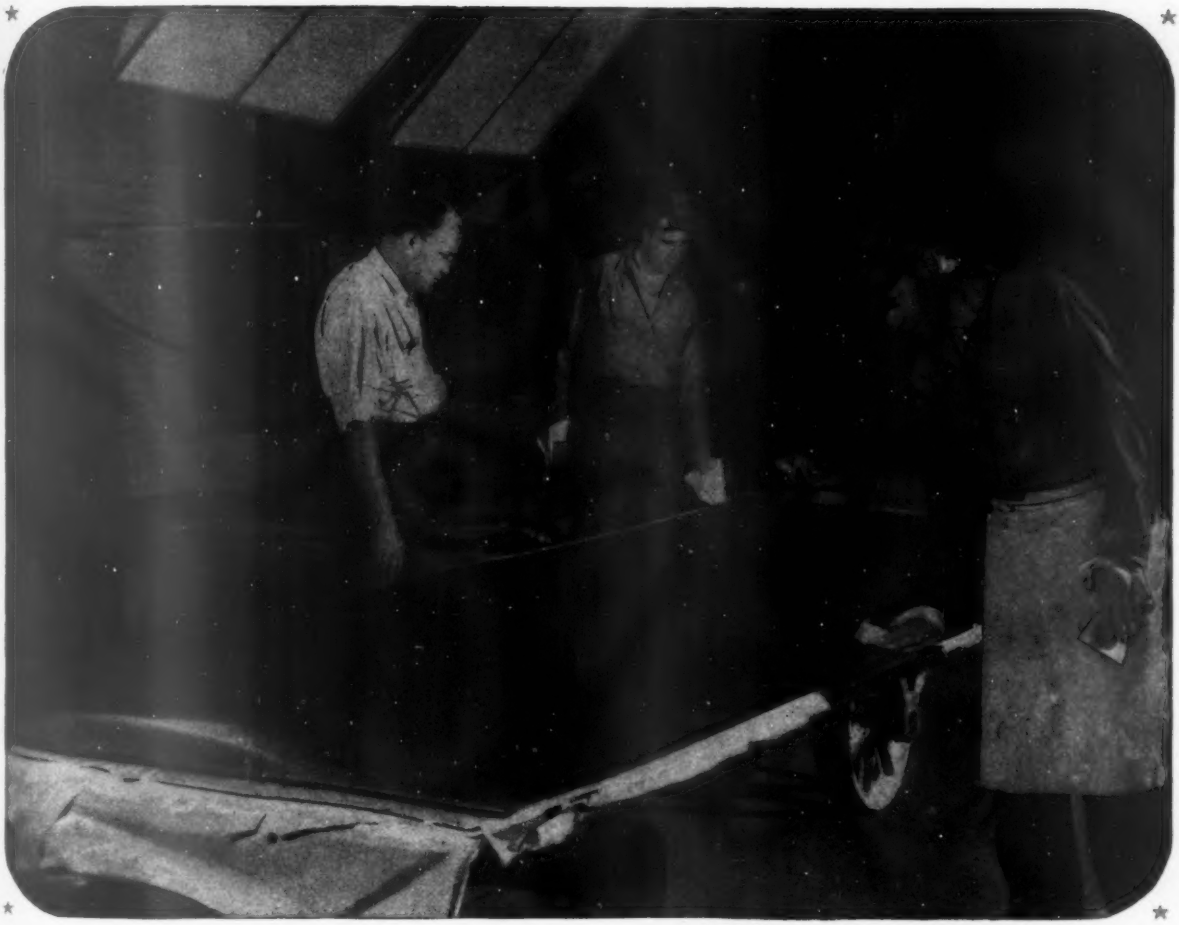
What is going to be done after this war for youths just like them, who are just as airminded, but who probably will not be old enough to join the Army or Navy air forces before the war ends?

* * *

WHAT we had to say about the Civil Air Patrol last month stirred up what apparently has been a seething question for some time. The majority agreed with what we said about CAP leadership in Washington. A few CAP members interpreted our remarks as being critical of their efforts to do a good job. We deeply regret the latter, because we thought we had made it plain that we have only the greatest admiration for the efforts of CAP members. Frankly, we've often been amazed at the personal and financial sacrifices that have been made by the majority of CAP members. Most of them have been carrying on, in other words, almost entirely on their own, with little or no progressive direction from headquarters in Washington.

Potentially—as we said last month—the Civil Air Patrol is one of the most promising aviation organizations inside the United States. That's why we joined, almost a year ago. This writer holds the rank of captain and is wing intelligence officer for the State of Illinois. We've read training manuals, directives and miscellaneous literature—all of it excellent

(*Continued on page* 167)



O W I Photo by Palmer, in an Allegheny Ludlum Plant

Final Examination

BEFORE STAINLESS GETS ITS WINGS

REDUCE ACCIDENTS!

In 1941, accidents were first cause of death among men from 22 to 38 years of age. The productive man-days lost were enough to build twice as many battleships as now possessed by the combined Allied Navies. These are losses that *can* be avoided. Warn your employees repeatedly not to take risks on or off the job—cooperate in every way possible with the National Safety Council's *War Production Fund to Conserve Manpower,* William A. Irvin, National Chairman, Chrysler Building, New York City.

A GREAT DEAL of costly processing is done on stainless steel, to secure the physical characteristics and surface finish required for the particular war job it is to perform. But one day all the hot and cold rolling, heat treating, and pickling, grinding or polishing is completed, and bright sheets of Allegheny Stainless lie on protective layers of heavy paper, ready for final inspection and shipment to the war plants.

They're *right,* those sheets—flawless of surface and true to desired specifications. Only one essential remains: that they be used as carefully as they were produced—fabricated with an absolute minimum of rejects, spoilage, undue scrap, or waste in any form. ● Call on us for any printed data or personal help.

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Allegheny Ludlum
STEEL CORPORATION
BRACKENRIDGE, PENNSYLVANIA

A-8823 . . W & D

worth waiting for!

His was a big job but the job the Marines are doing is more important right now . . . so away he goes with best wishes to the loyal secretary who will carry on until he returns.

Culver, too, is devoting full time production to planes for our armed forces but our engineers are working way ahead planning . . . perfecting . . . the new *Victory Model Culver* that will be ready for you after today's job is finished. It will be a cleaner, more efficient cross-country airplane than ever before. When you see it you'll agree that it was

worth waiting for!

UNDER CONTRACT TO THE
U.S. ARMY AIR CORPS AND THE U.S. NAVY

CULVER

AIRCRAFT CORPORATION

CULVER AIRPORT
WICHITA, KANSAS

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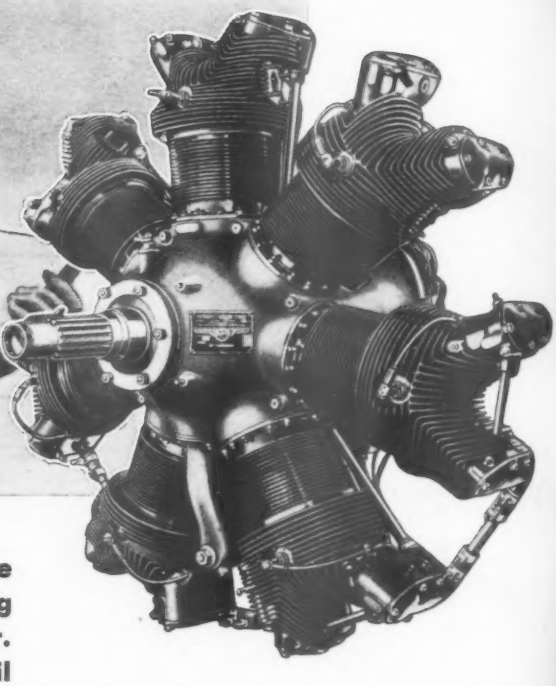

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...the Axis won't print

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...not away, he made a ...nding and saved his plane.

Lt. Jemison was a member of a flight of Airacobras assigned to the task of strafing Lae, New Guinea, on May 4. When bad weather made it impossible for the whole formation to reach the target, Lt. Jemison attacked individually, destroying one enemy bomber grounded at the airdrome and badly damaging two others.

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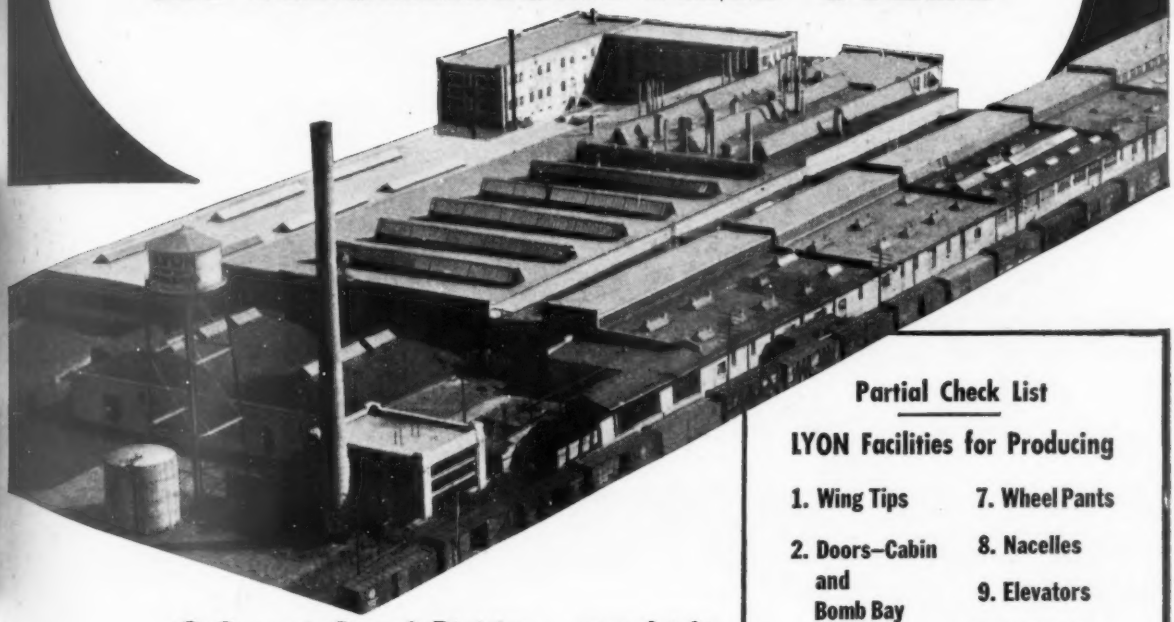

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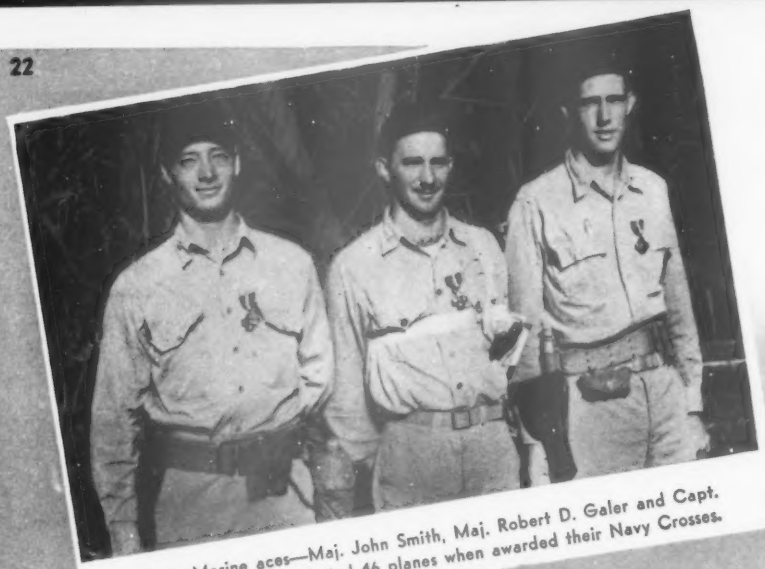


Three Marine aces—Maj. John Smith, Maj. Robert D. Galer and Capt. Marion Carl—had blasted 46 planes when awarded their Navy Crosses.

by Maj. Gen.
RALPH J. MITCHELL
USMC
as told to
REX SYDNEY

MARINE AIRMEN O

Quick action salvaged this Grumman "Wildcat" set afire when Jap bomb hit hangar during raid on Guadalcanal airport.

Until bombed, this pagoda was Henderson Field headquarters for U. S. forces.

ON GUADALCANAL

Six months of savage aerial warfare for possession of Guadalcanal ends with the situation well in hand.

Photographs by U. S. Marine Corps, U. S. Navy.

BRILLIANT and imperishable American military history was made during the six-month battle for Guadalcanal and some of the most lustrous chapters were those inscribed by the intrepid young airmen of the U. S. Marines.

Marine planes first touched wheels to the island's coveted airfield on August 20, two weeks after our ground forces had landed—and when the last organized enemy resistance had collapsed six months later, Marine flyers still were taking their toll of Jap Zeros and bombers at every opportunity.

Initially, they were carrying out their primary mission of supporting the Fleet Marine Force—the Corps' amphibious ground troops—but in all stages of the campaign, they operated in conjunction with units of both the Navy and Army air forces. In the half-year of savage fighting for the strategic outpost, during which the Jap strove desperately by land, sea and air to rout the Americans, Marine flyers destroyed almost half of the approximately 1,100 enemy planes accounted for in the fighting. They sank many of the 72 ships lost by the enemy in the area and particularly did their blazing guns and accurate bombing also take a heavy toll of Japanese land forces.

The conquest of Guadalcanal has been described as a triumph of teamwork—teamwork on the part of all the major elements of America's fighting forces—and, of course, that's true. However, it also demonstrated clearly that those forces are the masters of the Japanese in every respect, in the air, on land and sea. The box score of Marine aviation in the Solomons rather conclusively substantiates that contention with respect to that branch of the service. It is drawing no invidious comparison to repeat that the four leading American air aces of this war are Marines—27-year-old Capt. Joseph J. Foss of Sioux Falls, S. D., with 26 Jap planes to his credit; Maj. John L. Smith of Lexington, Okla., with 19; Capt. Marion Carl, 26, of Hubbard, Ore., with 16, and Maj. Robert E. Galer, 28, of Seattle, with 14.

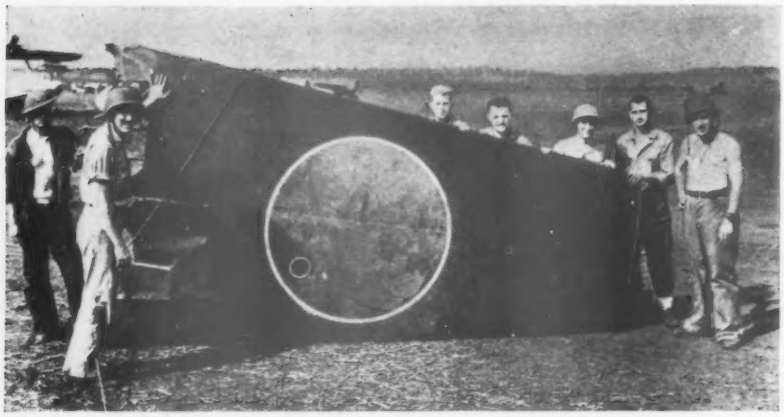
From the time that units of the Second Marine Aircraft Wing, under the command of Lieut. Col. W. J. Wallace, went into Guadalcanal, their skill, daring and training plus the superior handling of their planes made them more than a match for the Jap aviators. Right from the beginning, Marine pilots in their Grumman *Wildcat* fighters were knocking down the vaunted Jap Zeros in numbers which must have been disturbing in certain circles in Tokyo, to say the least. On occasions the ratio of Jap plane losses to our own was as high as 20 to 0.

In spite of the greater maneuverability and speed of the Japanese fighters, Marine pilots soon discovered techniques and tactics to compensate for those disadvantages. As Major Smith (or "Smitty" as he was called on Guadalcanal) put it when he returned to the United States, the best Jap planes couldn't fly faster than the .50 caliber slugs from American machine guns.

To illustrate the fantastic proportions to which the proportionate losses in planes went in the early months of the campaign, reports from the field reveal that from September 25 to 28, there were 42 Jap planes shot down without the loss of a single United States plane.

That was the month in which the now fabulous "Hollywood Joe Foss' Flying Circus" arrived on Guadalcanal. By January 5 of this year that group had shot down a total of 62 planes, 23 of which Foss accounted for by himself, and the entire squadron to which the "circus" belonged had bagged a total of 132 Jap planes.

Much already has been written about the individual exploits of the Marine Corps' aces, but there are certain paral-



Section of wing was the largest single piece to flutter down on the island when a Jap bomber, hit by antiaircraft shell at 20,000 feet, disintegrated.

lels in the case of Smith and Foss which seem to me to be worthy of note. Both are typical of the high-caliber young men who have chosen Marine aviation in which to serve. Both came from families in modest circumstances and both were members of the Reserve Officers' Training Corps at college.

By another coincidence, both won Bachelor of Science degrees, Smith getting his in business administration, for he had majored in accounting and had passed Oklahoma's examination for certified public accountants. Instead of entering business, however, he accepted a commission as second lieutenant in the Marine Corps in 1936 and went at once to its basic training school for officers at Philadelphia. It was four years later before Foss, a graduate of the University of South Dakota, joined the Corps for flight training.

Smith's most sensational combat exploit was the destruction of four Jap Zeros within a 15-minute period. Foss, on the other hand, bagged three enemy planes in a matter of seconds last November 12 when he picked off a Zero at 29,000 feet, then dived to less than 3,000 feet and got two torpedo bombers. The preceding month, he bagged four Zeros in one day and destroyed four others in an hour and 15 minutes three days later.

Tojo provides trophy as Marine flyers compete for captured Jap emblem. First to down three Japs was winner.

Despite the superb performances of the Leatherneck flyers, there were occasions in the early part of the campaign when the Marines' grip on Guadalcanal was none too firm and secure. At that time the vitally important airfield would accommodate only a limited number of planes. Dispersal areas were inadequate, making it difficult, sometimes impossible, to protect the planes from the incessant bombing and shell-fire.

Gradually, however, conditions improved for our forces and the terrific punishment being meted out to the Jap airmen was steadily depleting their first-line strength in both planes and pilots. On occasion, they apparently were reduced to the point where they had nothing but slow float-type Zeros, no match for the Grummans. Captain Carl told how 10 of the float-type came over late one afternoon and met virtually complete destruction.

"We'd have done better," Carl said with a slow smile, "but we only managed to get two of our planes into the air before it got too dark to fight."

Beating off the waves of bombers and fighters which the Japs sent over with clock-like regularity every day between noon and 2 p.m. was not the only mission of our Marine pilots, however. They made countless attacks on Japanese warships and transports in the area and carried out many bombing and strafing attacks on the enemy troops seeking to regain control of the airfield.

From August 25, 1942 to January 1 of this year, a tabulation of damage to Japanese shipping by Marine Corps dive bombers listed one Kongo-class battleship as possibly sunk by four hits, one heavy cruiser sunk, one possibly sunk and three damaged; two destroyers sunk, five possibly sunk and 20 damaged; two troop-carrying destroyers sunk; eight cargo ships sunk and one possibly sunk

(*Continued on page* 163)

Grumman "Wildcat" taking off at Henderson Field shortly after Japs were routed from this strategic Pacific point.

The PRESIDENT'S FLIGHT

Two flying boats and a landplane took part in the historic flight of President Roosevelt to his Casablanca conference.

U. S. Navy

Celebrating President's birthday in flight aboard "Dixie Clipper" are (left to right) Admiral Leahy, the President, Harry Hopkins and Captain Cone.

By JOHN MURDOCH

SOMETHING was up. The Dixie-born skipper of the *Dixie Clipper* knew it. But he didn't know just what. Since the summer of 1939 all Pan American Airways transatlantic flights had been "routine" in the sense that they were scheduled operations following a definite pattern of procedure. Since the war began, of course, certain changes had been instituted, but insofar as the operation was concerned each flight remained routine.

Somehow, this was different. Skipper Howard M. Cone, Jr., and his crew sensed it. Care always had been lavished on the preparations for a flight, but even more than the usual care had been taken this time. Moreover, each man knew without being told that his tight-buttoned lip had to be buttoned even tighter. If the flight was routine, the person or persons coming aboard would be something extra-special.

There was not one plane, but two. That must mean something. An air of mystery had hung heavy over the preparations for the trip of the *Dixie Clipper* and her sister ship, the *Atlantic Clipper*, from the time the order first went out to prepare the two planes for an unidentified mission until they had faded into the mists over Long Island Sound.

The Secret Service and others charged with safeguarding the President had done their job well. On the neatly-typed "weight and balance manifest" which ordinarily lists the names of all passengers and which serves to inform the captain of the weight of payload to be carried appeared only "Passenger No. 1, Passenger No. 2," etc.

Now Captain Cone waited in Miami, listening to the lazy slap of waves against his ship's hull. The cool of the Florida morning was in contrast to the biting winter cold of New York. Some 20 minutes before passenger arrival time, a second list was handed Captain Cone. Glancing at it, he noticed: "Mr. Jones, Mr. Hopkins, Admiral Leahy, Admiral McIntyre, Captain McCrea, Arthur Prettyman" and so on. There was only one person "Mr. Jones" could be—and that was . . . But by this time the official party had arrived and the President of the United States was coming aboard.

"I never had had the experience of welcoming aboard a President of the United States and correct protocol for the occasion was a problem," Captain Cone explained. "Standing in the passenger lounge I knew that the palms of my hands were cold and clammy. I guess what I did say when 'Passenger No. 1' at last stepped through the entrance door was, 'I'm glad to have you aboard, Mr. President.'"

By the time the President had made his way to his private compartment aft and the sleek, camouflaged Clipper had slipped her moorings and taxied to the take-off area, the first tints of dawn were fringing the eastern sky. Captain Cone, veteran of nine years of ocean-hopping over both Atlantic and Pacific in Pan American Airways flying ships, was at his accustomed take-off station up forward with his feet on the rudder pedals. The four *Cyclone* engines with their 1,550 h.p. each, split the morning calm with a deafening roar, but inside the huge hull the passengers heard only the muffled rumble that indicated the Clipper was being swiftly air-borne, well-started on one of the most momentous flights in aviation's history and world history.

(*Continued on page* 164)

AUTOS TO A

by L. C. GOAD

General manager of the Eastern Aircraft Division of General Motors, "Cliff" Goad has welded five automobile plants into one plane factory. Following graduation from college, he came to the company in 1923.

"BOSS" KETTERING has described war as a sort of inverse economics. In economics, according to his definition, you try to make an article the customer needs, deliver it to him when he wants it and at a time when it will be of service. In war you try to sell him something he didn't order and that he doesn't want and you deliver it when he least expects it.

This definition has the humor of reality to the automotive industry which, since December 7, 1941, has undergone just such a reversal of philosophy. And with particular reference to aircraft manufacture the automotive industry also has undergone a reversal of techniques to a considerable extent. This reversal is of such dimensions that one of the industry's key phrases, *mass production*, has come to have a somewhat different meaning. Its quantitative aspects must be revised—downward.

The first General Motors-built "Avenger" (TBM-1) is checked before a flight test.

The fact need not frighten us at all. But the fact ought to be understood thoroughly to forestall any public misconceptions. The war is costing the public some quarter of a billion dollars daily and the public is entitled to facts, not catch phrases.

Let me confess at the outset that I am a "Johnny-Come-Lately" to aircraft production. My entire career has been devoted to problems of automotive manufacture, most of it in the accessory business. In the matter of how to produce spark plugs or batteries I could speak with some authority. In the complex field of aircraft manufacture I don't pretend to know all the answers. But for the last year we have been finding the answers to some of the aircraft problems and we have been finding them the hard way—working around the clock immersed to our necks in machines, techniques and nomenclature unknown to us 12 months ago. Needless to say, we've learned something and we've come to have a high regard for the aircraft industry. And on the basis of our experience I believe we can venture a few observations which I hope will clarify some points that have created misunderstanding in the past.

Much of the difficulty, I suspect, has arisen from a somewhat loose application of the phrase "mass production." Mass production has come to be universally accepted in the public mind as the keystone of America's industrial leadership. More literally the phrase conjures up a picture of American automobiles

AIRCRAFT

American people who dream of planes rolling off one-time automobile assembly lines at the speed of cars, don't reckon with a plane's complexities.

Photographs from General Motors

rolling from the assembly lines at the rate of one every 60 seconds or better. It was only natural that a similar picture was envisaged when the phrase came to be applied to aircraft production, especially after the automotive industry announced its conversion plans. The fact is, however, that we shall not see in this war mass production of airplanes on the numerical scale of the pre-war automotive industry.

This does not mean that the automotive industry has fallen down on the job —or will. Presently I will outline what the automobile industry can contribute to its newest assignment. Already its influence has been felt. President Roosevelt told Congress in January that America is now producing more than 5,500 military planes monthly, a gain of 1,500 over the preceding May when the President last revealed aircraft production figures. And Chairman Donald M. Nelson of the War Production Board recently announced that "from now on deliveries of airplanes should increase considerably from month to month as new plants come into operation and progress is made in production and materials scheduling." But what I am trying to emphasize is that our monthly aircraft production, good as it is, still is a far cry from the 18,000 automobiles produced in a single month at General Motor's Linden, N. J., plant alone during the peak days of auto production. The comparison is not odious when one examines the phrase, mass production, in relation to automotive and aircraft manufacture.

To begin with, in the manufacture of automobiles production processing problems are definite factors to be considered every time a new model is designed. This is necessary because every piece of an automobile must be designed to avoid too many troublesome or complicated operations. Then accurate drawings and material specifications must be developed for every item and in this process it is essential that complete interchangeability of parts be achieved. Next, the physical plant layout must be considered with a view toward the performance of manufacturing operations, for these operations must be performed progressively if an orderly flow of materials is to be maintained in relation to auto assembly schedules. Wherever possible parts and units must be put together in sub-assemblies preceding final assembly so that many people may work on one job at the same time without getting in each other's way. Finally, where pieces are heavy and material handling is an important factor, conveyor systems must be

The U. S. Navy has designated this General Motors-built "Wildcat" as the FM-1.

Sprawled prone on their boards, draftsmen draw full-scale plans for the first "Wildcat" fighter.

used to reduce human effort and to facilitate the flow of materials in a systematic fashion.

If we could square all phases of airplane manufacture with that blueprint we could have mass production of airplanes just as we had mass production of automobiles. Why, then, cannot this blueprint be completely adapted?

The answer to that question is found in the major difference between these two types of products productionwise. Whereas in the automobile a given design is fixed over a definite and fairly long period of production the design of a modern warplane is fluid. It can be changed on a moment's notice—and is. That is probably one point most of us in the automobile industry failed fully to appreciate in the beginning. To the casual eye the design of a given airplane may not seem to alter much during a period of time; actually the design is in an almost constant state of flux and, although changes may be minute, they are numerous. The condition is one born of necessity. Victory in this war will go not only to the best army or navy but to the army or navy with the best mechanical equipment. The struggle for technological supremacy therefore goes on unremittingly in the laboratories and factories of the nation. And out of the experience gained by our aviators in mortal combat comes a steady stream of ideas for improvements which reach us in the form of orders to change or modify designs of various parts. Changes are also necessary to counteract improvements in the performance of enemy aircraft which also are undergoing constant improvement on the basis of the enemy's experience. Thus the circle is complete.

Such a condition violates the cardinal canon of automotive mass production: complete standardization of parts over a considerable period of production. Moreover, these changes frequently involve hundreds of operations, machine tools and parts. Security prohibitions forbid the use of actual figures but I can say that during the first six months of our actual operations we received orders to make more than 100 design changes in the two types of standard aircraft we are building.

Consider, for a moment, what these involve. One seemingly minor change affecting the main junction box of the electrical system actually involved some 5,000 operations although the change in dollars and cents was negligible. So many parts of the aircraft are interrelated that even the most minor reshuffle vitally affects many parts and in turn the tools with which these parts are fabricated. Aircraft manufacturers everywhere could tell a similar story. Like us, they have had to cope with constant changes, some of them retroactive to ships already delivered. Parts are sometimes tooled twice and even three times during a relatively brief period of production and cases are certainly not unknown where sections of assembly have been outmoded after a considerable stock has been accumulated. This is no transient condition. It will persist just so long as our engineers' and our airmen's experiences dictate their need; just so long, in fact, as we fall short of perfection in the full meaning of that word.

Dynamic designs have not only abrogated one of the basic principles of mass production, the fixed design, but they have also made themselves felt in tooling policies. Automotive tooling consisted largely of specialized machines built to do a single job. For example, an automobile builder might have a machine to drill all the holes in a cylinder block at one time. Perhaps it cost $100,000. Change one hole in that cylinder block and the entire machine became obsolete. But its economy of operation in a single model year more than made up for the price and premium of the machine. Thus automotive people

built up a condition they described as "heavy tooling," i.e., many specialized and expensive machines to do one job rapidly and economically. In building airplanes, however, the reverse is true. A policy of "light tooling" is necessary that encompasses tools of a standard or universal nature capable of doing more than one job or at least lending themselves to rapid conversion to meet fluctuating specifications. This, in turn, means that tools are made less of fine, expensive steels and more of plastics and substitute materials like masonite, kirksite, phenolic, etc. This, plus the fact that the pre-war market for airplanes was infinitesimal compared to the automobile market, explains why aircraft tooling differed so much in its development from automobile tooling. As a matter of fact, most airplanes of the pre-war vintage were pretty much custom-built affairs, put together manually on assembly floors by workers long skilled in the art. The light tooling policy is new to the automotive industry but it is essential under war-time conditions of manufacture and design.

Previously I have pointed out that every piece of an automobile must be designed to eliminate too many troublesome operations. Problems of design and weight could be subordinated, within certain limits, to achieve such an end. No liberties of this nature are possible, however, in aircraft manufacture. Everything in the airplane, including even the skin, is a structural member working right up to its elastic limits. Stress and weight count for as much and more than design and technique. With tolerances of some machine tools lined up to thou-

(*Continued on page* 152)

Once automobile parts were manufactured in this plant with massive machines. Now, however, riveters must fabricate wing assemblies for "Wildcats" on special jigs.

Special schools had to be organized to teach the employees new techniques before General Motors began plane manufacturing. Notice the number of women employees.

The open ditch is filled with oozing mud. If a pilot fails to complete the swing across, he gets a mud bath. Few fail. A complete obstacle course has been created especially for airmen—and they like it.

by CHARLES A. KEEFER

Physical perfection is as vital to the fighting pilot as is mental alertness. The Army is putting its airmen over the hurdles in a strenuous program of toughening each member of the Air Forces.

IN line with the intention of Maj. Gen. Walter H. Frank when commanding general of the Third Air Force to develop men of his command to be the "leanest, toughest fighting men possible to produce," a 220-yard obstacle course has been established at every Third Air Force base in 13 states.

One of these obstacle courses erected at Baer Field, Fort Wayne, Ind., shows how the airmen get plenty of arduous exercise—with a mud bath thrown in for good measure.

The mud bath phase of the training is self-inflicted punishment for failure to make good in the various departments of the course, including water jumps, hurdles and antitank traps.

Members of the Third Air Force may not have been track, gymnastic or football stars in civil life, but they soon become used to the rigors of these sports as well as familiar with the orders of military maneuvers in the field.

Credit for designing the layout goes to Lieut. Stephen O'Connell, physical training officer of the Third Air Force. The obstacles were devised especially for the training of Air Forces personnel. Regular workouts over the course should give men who fly the necessary muscle toughness and lung endurance for high altitude flights.

The first obstacle on the course is a six-foot broad-jump. Jumpers who miss this find themselves in three feet of water. After getting over the jump, the runner is confronted by parallel bars, four feet high and 12 feet long. These are negotiated with the arms and those who can't stick it out plunge into a mud bath.

The men then are required to leap four consecutive hurdles, each two feet high. Then comes a 12-foot ladder, to be climbed up and down.

After the ladder is surmounted, the airman finds himself face to face with a nest of wooden frames that are purposely set off-line. The object of this is to accustom the soldier to run zigzag. He may have to some day when his life depends on it.

Clearing the labyrinth of off-line frames, the runner next must negotiate a five-foot fence. Then comes a novel arrangement of uprights, crossbars, ropes

This vertical ladder arrangement will toughen arm and back muscles. Men are put through entire course every week.

and a mudbath. The uprights are 12-foot high and are connected by parallel bars. Under the bars is a mud-filled pit. From the uprights hang eight-foot ropes. The airman must climb the rope to the parallel bars, then swing himself across by his hands—again, the penalty for slipping is a mud bath.

Next comes a maze of tires that football trainees have known for years—the box field. These are used by football coaches to teach gridmen broken-field running and sidestepping. American fighters will learn to sidestep — not tacklers—but bayonet-jabbing enemy infantrymen.

Having negotiated the box field, the trainee comes up against a seven-foot wall. This he must scale. After he has scrambled over the wall he comes to the last obstacle—a frame tunnel hazard which makes the airman fall to his hands and knees.

The men are not required to complete the entire course the first time out. Two obstacles are attempted a week, until each man has negotiated all of them. Then field days are held with various units competing for prizes.

All personnel under 35 years of age are required to take the workout at least once a week.

END

Leg and thigh muscles get a workout as airmen attack double ladder.

Broken-field running and sidestepping is perfected with this set-up.

New ideas are tested in mock-ups. This dummy cockpit resembles that of a German Heinkel He-111 bomber.

THE intensity of World War II is reflected in the tireless, unceasing vigilance maintained at Wright Field, Dayton, O., headquarters of the Air Forces' Materiel Command. Not only does all equipment—from aircraft to zippers—have to pass the critical eyes of the Materiel Command's experts, but must stand up under simulated war conditions. Parts captured from the enemy often reveal vital secrets when put through a microscopic inspection routine at Wright.

Photographs by A. Eriss

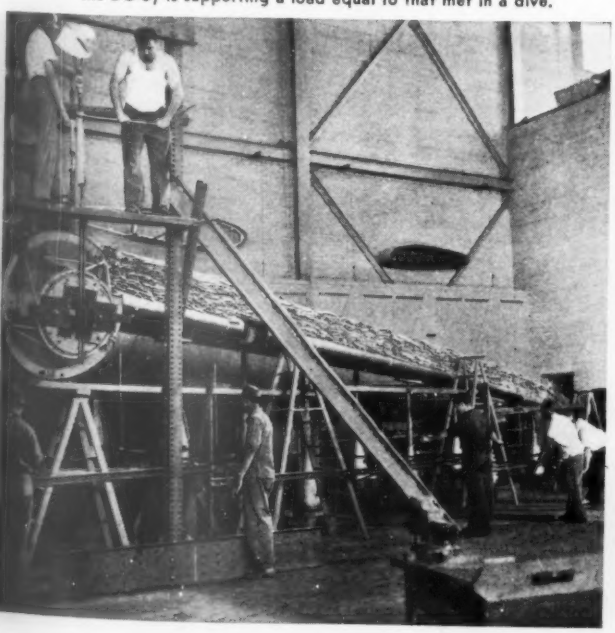
AIR FORCES' LABORATORY

The acid test of .50 caliber gunfire is applied to a self-sealing gasoline tank salvaged from a German plane downed in England. U. S. planes now use such tanks.

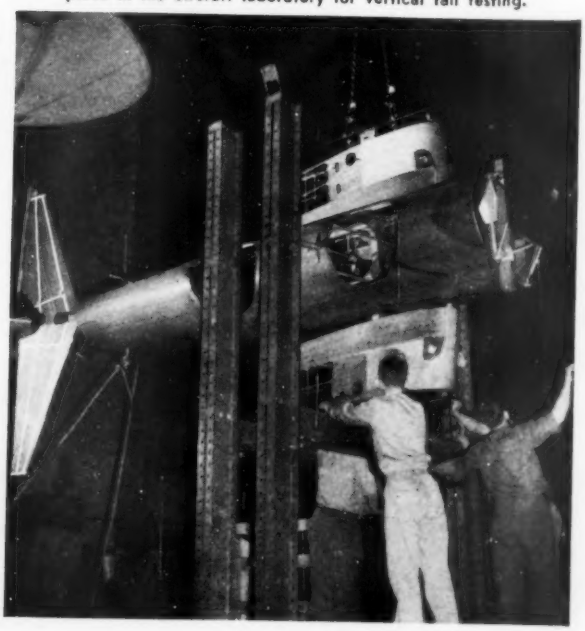
Observers check the stoppage of leaks as self-sealing tank survives the fusillade.

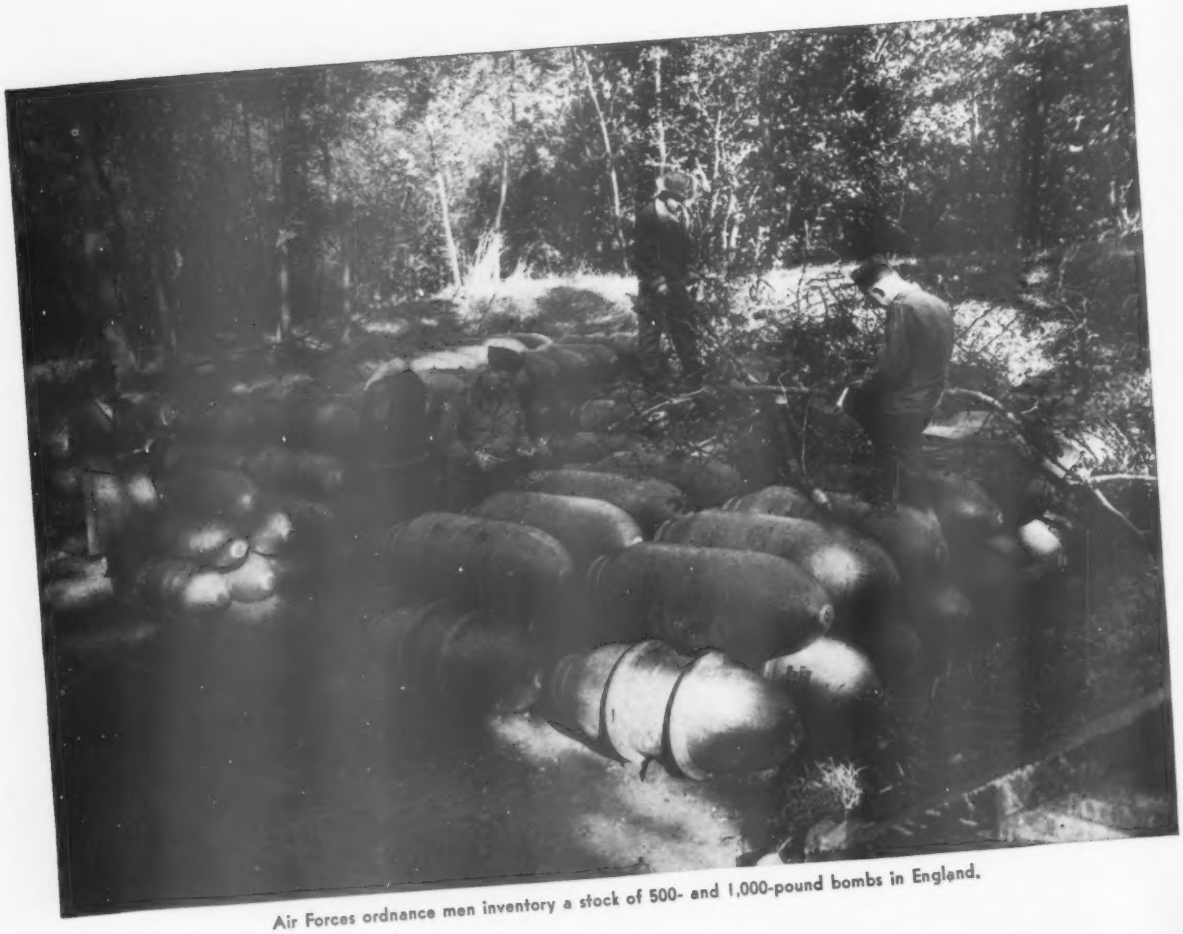
Weights are piled on wing of Republic "Thunderbolt" (P-47) to check stress analysis. Note ports for four guns.

The wing of a C-47 Douglas "Skytrain" (military version of the DC-3) is supporting a load equal to that met in a dive.



Fuselage and center section of a Ryan PT-25 is swung into place in the aircraft laboratory for vertical tail testing.





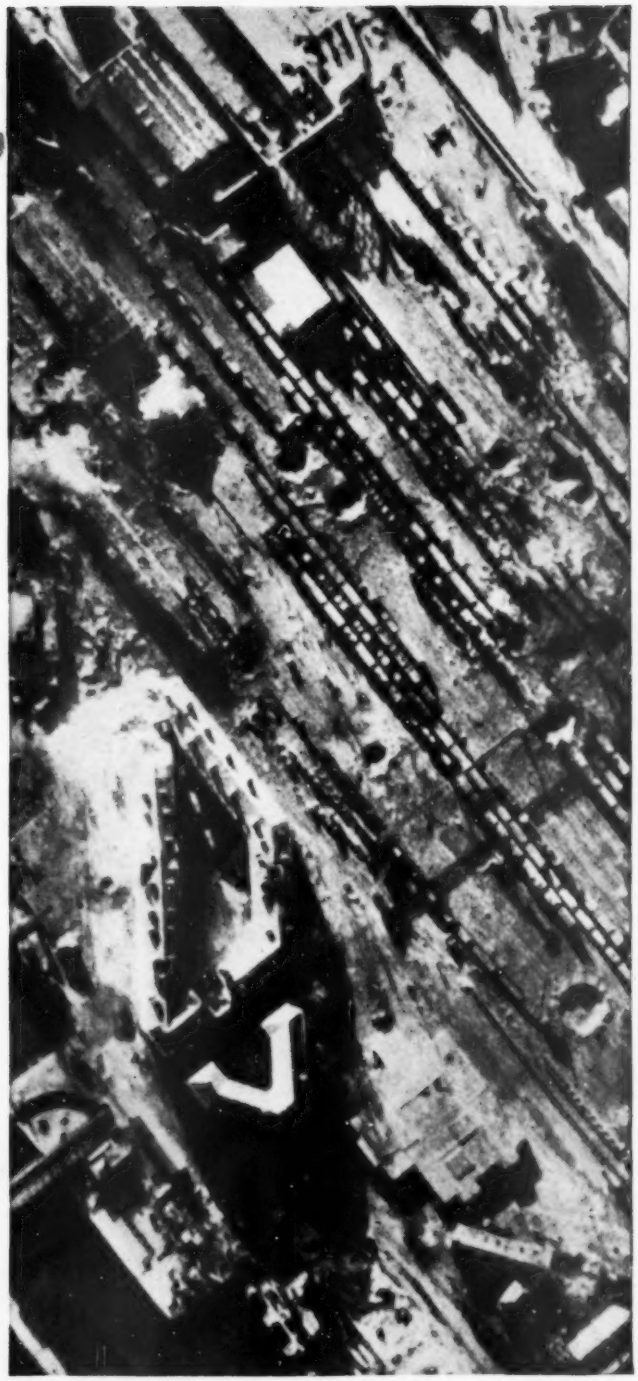
Air Forces ordnance men inventory a stock of 500- and 1,000-pound bombs in England.

Five 1,000-pounders get finned and fused before loading into their gun-studded "Liberator" for a raid on France.

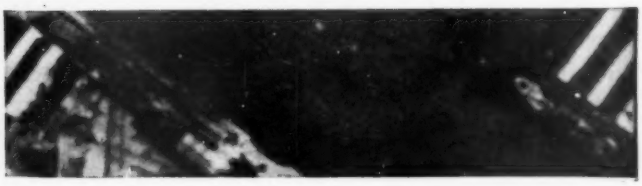
HELL RAISERS!

Photos from Acme and Central Press.

EVERY bomb on these pages is one more nail in Hitler's coffin. Tough young American aircrews are doing an increasingly fine job of hammering these nails home; the photograph at right is a small part of the whole picture. The airplanes doing all this damage are American heavy bombers, *Flying Fortresses* and *Liberators*. Shortly after the photograph directly below was taken, the *Liberator* had closed her bomb doors over "several" 1,000-pounders and was off for a French port. The *Katy Bug* is one of the latest *Liberators*, a B-24E. In addition to her heavy load of bombs, she carries a minimum of 10 .50 caliber guns. Her four 1,200-plus h.p. engines and their turbosuperchargers give the *Katy Bug* a service ceiling of 35,000 feet. *Liberators* now are serving in every theater of war, both as bombers and (as conversions) transports. The U.S. Navy recently got some, numbering them PB4Y's.



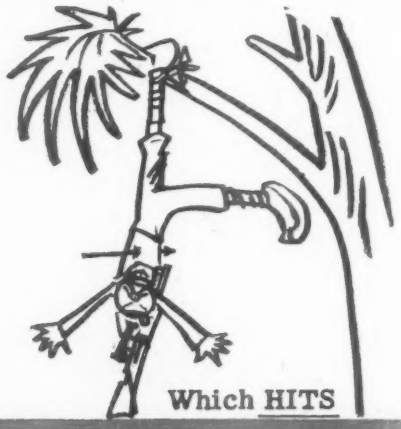
Smoke still curls from the ruins of the railroad yards at St. Nazaire, France, following a bombing visit by American bombing planes. Craters, varying from 25 to 50 feet in diameter can be seen along the car-loaded railroad tracks.



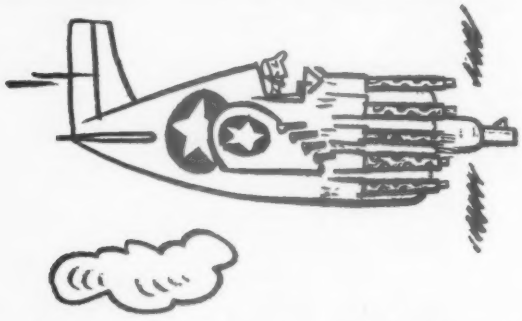
THERE IS NO

IT IS typically American that humor be injected into nearly everything we do, no matter how technical or complex. The booklet reproduced here illustrates that fact admirably. Produced by the Training Literature Section of the Navy's Bureau of Aeronautics, it humorizes a primary, deadly serious function of all pilots and gunners.

One Blow Gun

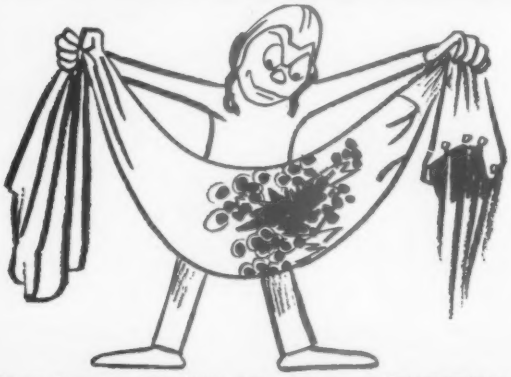


Which HITS

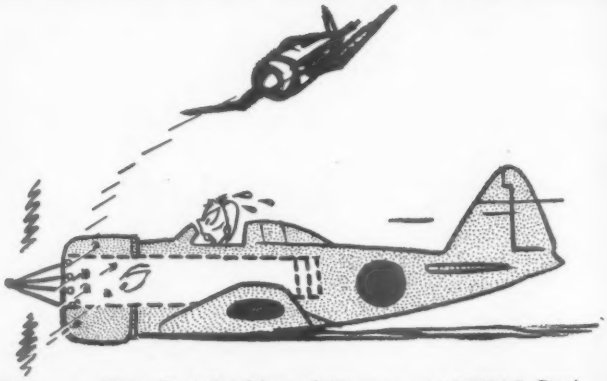


And All These Guns Are No Good To You
If You Can't HIT

And This One Gun Will Do The Job
If You CAN Hit



Then Learn To Hit The Sleeve EVERY Time



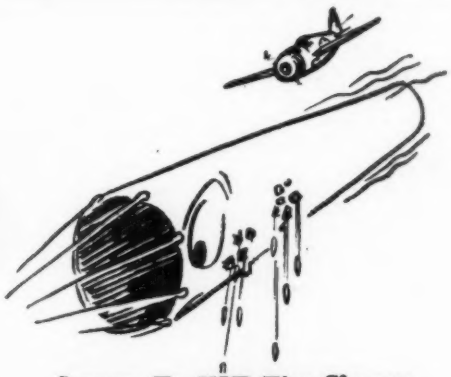
Then Get the Idea of Aiming at a VITAL Spot

SUBSTITUTE FOR MARKSMANSHIP

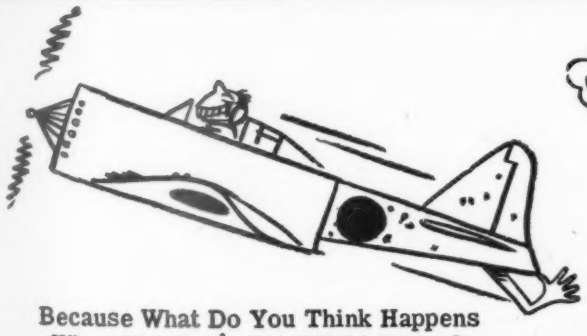
Is Better Than One 16 Inch Gun

Which MISSES

SO-

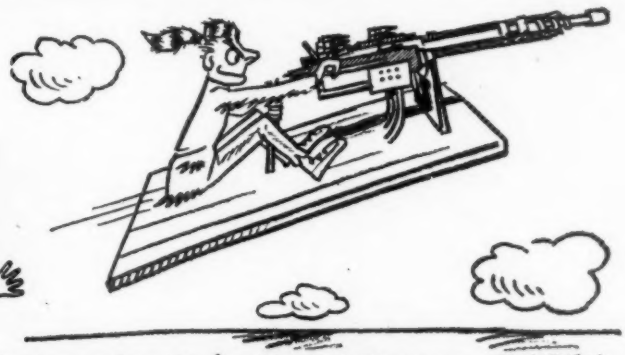


Learn To HIT The Sleeve



Because What Do You Think Happens When You Don't Hit VITAL Spots?

(that Jap comes back to fight another day)



So Remember You're Not Out There as a Hot Pilot But as a Really Hot Shot GUNNER

And the Plane is Just a Platform to Get Your Guns Up Where You Can Hit the Enemy Hard And Quickly. And to Hit Hard and Without Fumbling You've Got to Know LEAD and TECHNIQUE OF ATTACK (which is Position, Approach, Smooth Flying, Follow Through)
And You've Got
To Study, Think,
Visualize, Calculate,
Comprehend, Plan,
Plot, Practise,
Dream, Scheme,
And Devise
These Things -

Until YOU CAN'T MISS

Because You Always HIT

Everything You Aim At !

MEN BEHIND THE BOMBERS

Lockheed

by Wing Comm.
L. V. FRASER

Pilots do the spectacular work, but the accomplishments of the men on the ground are sometimes more astounding than those of the airmen.

BADLY hit over Germany, the bomber comes limping home. The moment it lands it is taken over by a maintenance crew and ground staff. A thorough inspection of the damage is made and the work of repair commences at once.

The speed with which these repairs are carried out is astonishing. Meal hours and sleep go by the board. The men eat on the job—often just a hastily snatched snack—and have no thought for bed until the bomber is ready for the air again.

They are real enthusiasts and take a high pride in their work. Their one aim is to get the "kite" into the air again. For as long as she is in their hands she is what is called U/S—Unserviceable—and, as such, she is as much out of the fight as though she were "written-off." She must be flung back into the bomber offensive with all possible speed and, to that end, repair goes on day and night.

Quite recently the maintenance staff—N.C.O.'s and aircraftmen—of a certain squadron completed a major repair job in record time. A *Halifax*, home from a bombing attack on the Ruhr, was so badly shot up that only first-class piloting and steadfast courage got her back at all.

The port inner engine had been hit, the longitudinal metal ribs had been pierced, a shell had gone right through the port tail fin and there were 12 holes in the starboard fin. The jointing of the front spar, which carries the wings, had been holed, the main bomb doors were damaged and fuselage and wings riddled by flying fragments.

"I'm afraid it's going to be some time before we can take her up again," remarked the captain of the bomber ruefully to Corp. Jack Osborne, who was there in the dawn to make a first inspection of the damage.

British Combine

Back at its British base, this riddled "Hudson" is turned over to maintenance crews.

Corporal Osborne, a monotype keyboard operator before he joined the RAF as a fitter, carried out his inspection, and reported the damage to Flight Sergt. J. S. Pennington, the small, sandy-haired chief of the maintenance flight, who worked himself up from a boy apprentice of 15 in 1924.

"It looks a bit of a mess, all right!" concluded Corporal Osborne, having detailed the damage. But they cleared up the mess to such good effect that three nights later, thoroughly airworthy and in first-class trim, the *Halifax* was once again over Germany with a full bomb load.

The whole of the repair work on this machine could have been carried out at the dispersal point if the port inner engine had not had to be changed. This meant taking the bomber into the maintenance hangar where a crane could be

(*Continued on page* 90)

GLIDER TRAIN

A STRANGE-LOOKING formation rolled down the runway at Lewis-Lockport, (Ill.) field recently and took off in the direction of Chicago municipal airport 30 miles away.

In front was a 225 h.p. cabin Waco, and behind—on ⅜-inch manila tow ropes 350 and 400 feet long—were two trim, clean-lined red high-performance gliders, each bearing a pilot and one passenger. Ground assistants ran along a few steps to steady the gliders' wings, and the motorless craft quickly left the concrete, rose to 15 feet, then dipped in unison to allow the towplane to get off.

A half hour later tower men at the Chicago port were in a dilemma as the glider pilots, somewhat unversed in landing etiquette at a busy terminal, disengaged their towropes at the Waco's signal and came down in a series of lighthearted maneuvers, leap-frogging a line of four-motored bombers to land on the main ramp. In such a manner the first long distance glider-train in American flying completed the initial leg of its four-day, 1,000-mile flight.

The idea of hitching two gliders behind a standard cabin ship and starting off on a long cross-country jaunt was still in the realm of maybe-it-can-be-done when Harry B. Combs of Denver, Colo., decided to try it.

Combs, just past 30 years old, is president of the Mountain States Aviation company, CAA flight contractor for both Denver and Colorado Universities and one of the country's larger civilian training operators. Denver U., one of two institutions of its kind in the nation offering college credits for construction and flight work in gliders, had just purchased two army-trainer model high performance gliders from the Frankfort Sailplane

S. R. Corcoran, who designed the high-performance gliders, piloted one of two powerless craft forming aerial "train."

by ELVON L. HOWE

Everybody was talking about the glider trains of the future. Denver University took time by the forelock with its air train of the present.

Photographs by Ralph Baird and Acme

Company at Lockport, Ill., and Combs, whose previous towing experience had been confined to looking at pictures of imaginary sky-trains of the future, offered to attempt delivery by air.

Starting at Lockport, and with fueling and overnight stops at Chicago, Moline, Ill.; Des Moines, Ia.; Omaha, Grand Island and North Platte, Nebr.; and Fort Morgan, Colo., en route to Denver, the trip was completed without mishap after covering almost exactly 1,000 airline miles. It was productive, not only in writing the first long-distance multiple-tow experiment on American record books, but also in pioneering much of the practical experience which must be gained before passenger and freight carrying by this method can become common.

Combs flew the towplane the entire trip, accompanied by Conrad Greenmeier, Mountain States' maintenance superintendent, as engineer and trouble-shooter. Greenmeier, besides his routine duties in keeping the flight in the air, was responsible for designing a heavy-duty tow-hitch and installing top and side rear-view mirrors which the pilot pronounced "absolutely indispensable" for the operation.

At the controls in the rear, portside glider was Stanley R. Corcoran, designer of the gliders and vice president of the Frankfort company. Corcoran flew all the way in the more difficult lefthand position, where it is up to the pilot to keep clear of the craft just ahead and at the same time contend with the full effect of the towplane's propeller wash. Ben Kunz, chief flight instructor at Denver University, completed the crew as pilot of the starboard glider.

Along as glider passengers were William E. Barrett, Denver aeronautics expert, and John T. Lynch, director of the university's glider school.

Even on the short hop to Chicago it became plain that cold weather would be both a curse and a blessing. Corcoran, Kunz and the two passengers, in their unheated, drafty gliders, were cold, but at the same time the cold helped eliminate what had been feared as the most difficult mechanical obstacle to the flight —overheating of the Waco's motor.

"Watching the head temperature gauge climb to 325°, 350° and 375°," Combs says, "Greenmeier and I thought the trip would be over before we even reached Chicago. But it reached 400°, our maximum safety limit, and stayed there. Later, as we learned the most efficient flying formation, we had only occasional difficulty in keeping motor temperature in a safe range."

Monday morning at Moline, the weather was colder and unpromising, and the double hope to Des Moines and Omaha that day proved to be the most punishing part of the trip for all concerned. A sharp 30-mile headwind out of Moline pitched the light, 500-pound gliders and their riders about like chips on tumbling water and forced them to fly farther apart for safety.

Long before, the glider pilots had abandoned anything resembling a V-formation because of the greatly-increased drag on the power ship, and were flying at about 40 feet above the towplane's level as nearly as possible on a direct line behind it, the rear glider straight behind and the other a little above and to the right, with its wingtip overlapping the line of the rear glider's towrope. This formation added materially to the speed and was found to bring the towplane's head temperature down a full 25°.

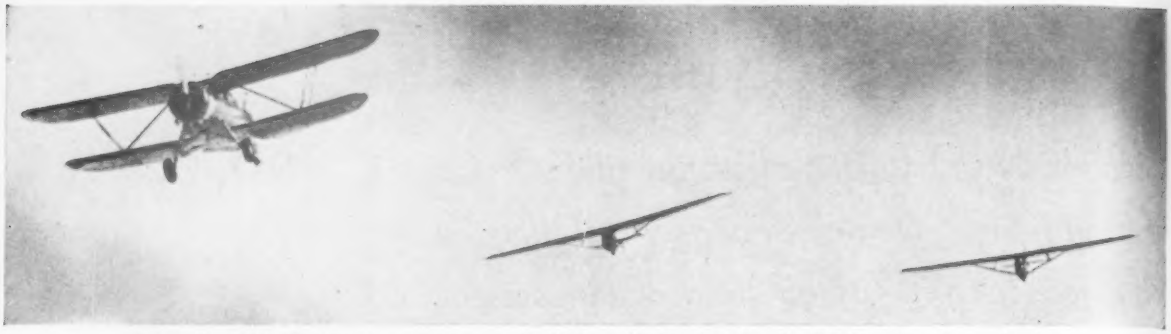
It was on this leg of the flight Combs discovered that rough air, even more than a strong, steady wind or otherwise poor weather, is the greatest consumer of fuel and speed in cross-country towing. Each time the towplane strikes a thermal and reaches its normal recovery point, instead of maintaining speed it is dragged down as the gliders catch the riser.

Freezing and fighting their sticks in constant adjustments required to keep the towropes taut and avoid collision, the glider pilots circled down at Des Moines shortly after noon on Monday, having incidentally hung up a new 165-mile national record for a single hop of gliders in multiple-tow.

The take-off two hours later required extra volunteer hands to hold the bucking gliders on the airport long enough for pilots and passengers to climb aboard. The wind, still rising, was whipping swirls of light snow across runways already ice-sheeted, and it was here that Barrett slipped and fell while wrestling one of the gliders and made the rest of the trip with what he learned a few days later was a broken rib.

Another painfully rough two-hour ride

Gliders prepare to cut loose from Waco towplane as train circles Hayden Field.



Flying the 1,000 mile trip at an average speed of 85 m.p.h., the pilots found a "V" formation too much of a drag on the towplane. A position 40 feet above the Waco and in almost a straight line proved most satisfactory.

that afternoon brought them to Omaha, and both plane and glider occupants made a concerted dash for a hotel and a hot bath.

Tuesday was clear as the flight headed west. A healthy tailwind, their first such good fortune, would have made it easy to reach North Platte in a single hop. But the flight plan called for an intermediate stop at Grand Island, and when Combs was unable to make radio contact with that port for permission to change the plan he decided to obey the rules and make the stop. He was forced to sit down in a small auxiliary field when the Army-operated main airport, uninformed of the flight, at first declined permission to land.

The size of the smaller field made it doubtful if one glider, to say nothing of two, could be taken off. But discarding passengers and baggage, Combs barely cleared his wheels over the fence with one glider in tow, took it to 1,000 feet, and cut it loose. He had landed, hooked on the other glider, and taken it up before the first had landed on the Army field five miles away. Completing the transfer without mishap the flight enjoyed its first really good weather on the way to North Platte, where another overnight stop was made.

A storm was brewing, however, as the tow-train climbed toward Denver's mile-high altitude the final day. A headwind registering up to 40 m.p.h. prevented a direct 220-mile hop to the city because of the Waco's limited fuel capacity, and arrangements were made for a stop near Fort Morgan, Colo.

Here for the second time take-off difficulties were encountered. At the higher elevation the Waco used nearly every yard of a 7,000-foot runway to get into the air.

"Wouldn't you have been in a tight spot if you had failed to clear on either of these close take-offs?" Combs was asked.

"In that case," he replied, "we had it understood that the towplane would drop the ropes and take care of itself, and the gliders would cut loose at their end, soar and come back on the field. Even from a few feet these particular high performance gliders could soar to 100 or more, and since they are so maneuverable as to be able to make four complete 360° turns under 100 feet, there was little worry about the gliders."

At Denver, a crowd of hundreds stood on Hayden field as Combs and his companions circled the city and landed to receive the congratulations of Chancellor Caleb F. Gates, Jr., of Denver University, Mayor Benjamin F. Stapleton and other officials. (Two days later a telegram arrived from the Civil Aeronautics Administration in Washington bearing the news that the flight, which had been conducted under a special waiver from regional CAA officials, could not be permitted!)

The trip was made at altitudes between 1,000 and 2,800 feet, ground clearance, and at speeds averaging 80 to 85 m.p.h.

Compiling the results of the flight and the data obtained, Combs believes the practicality of glider-trains has been demonstrated even with the comparatively makeshift equipment available for this jaunt.

Adding the burden of two fully-loaded gliders, he said, increased fuel consumption 20 per cent, reduced speed by one-fourth, and more than doubled the Waco's load-carrying capacity. Holding a little right rudder to counteract the side-pull of the starboard glider, and cruising the Waco at 1,800 r.p.m. rather than a more normal 1,700 helped considerably in efficiency.

Among the more obvious improvements placed in the "must" class on this flight, Combs lists the following:

Larger fuel capacity in the towplane.

Cabin heaters in the gliders.

Intercommunication.

A redesigned cooling system for the towplane motor.

Built-in rear view mirrors.

Automatic reels for drawing tow-ropes back inside the power ship, elimnating the time-consuming process of handling ropes on the ground.

At each stopping point on this trip the gliders cast loose to pick their own landings while the towplane recircled the field low at high speed to drop the ropes, then circled again to land.

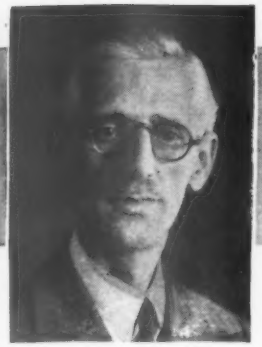
Several other bits of aeronautical knowledge gathered en route may point the path which future design of towplanes and their cargo-gliders will take.

Solely on the basis of his experience, Combs foresees a future locomotive of the air built around a big, high-lift wing and a powerplant ample in size and cooling surfaces, designed to travel at moderately fast speeds and to carry a minimum load within itself—perhaps only auxiliary fuel and room for pilots and engineer.

The latter point, he believes, will prove an important element in efficient design because on the trip from Chicago, the weight of an additional passenger in the

(*Continued on page* 144)

Harry B. Combs, who organized glider train and flew the Waco towplane, was well pleased at results. He has suggested changes to improve future trains.



LONDON SURVEY

by E. COLSTON SHEPHERD

The first in a series of exchange columns is written by the noted editor of "The Aeroplane."*

A reporter on English newspapers before World War I, Mr. Shepherd began devoting his ability to aeronautical interests in 1929, as aviation correspondent for the London "Times." Among his books on aviation are "The Air Force Today" and "Great Flights," both published in 1939, at which time he became editor of "The Aeroplane."

IN LOOKING at recent developments in the British aircraft industry the thing which stands out, because of the influence it may have on aeroplane performance on both sides of the Atlantic, is the entry into service of the Rolls-Royce *Merlin 61*. Now that this engine has become an Anglo-American product, the latest development of it is in the nature of a promise for both countries. There are good reports from Tunisia of the work of the Curtiss *Warhawk* or P-40F which has a *Merlin*, and lately Great Britain has been satisfied of the ability of the *Spitfire IX* to deal adequately with the Fw-190.

The engine with which we began the war has advanced so successfully that there is every chance that it will still be going strong when the war ends. And the story strangely enough is one of keeping capacity low and consumption high. The resolution on the part of the *Merlin's* designers to burn more and more air, without increasing the space in which it is burnt, is presenting the air forces of the two nations with speed and height. Rate of climb and power of maneuver still remain the business of the aeroplane and airscrew designers but, even without disclosing the power output of the *Merlin 61* (so far forbidden), there are some indications of the remarkable advantages derived from high supercharging.

At 40,000 feet the power given by the *Merlin 61* is double that which would have been delivered by the original *Merlin III* at a corresponding height. In making that improvement almost the only change in dimensions has been an increase in length by five inches. Two-stage supercharging, with an intercooler between the impellers and the cylinders, affords the whole explanation apart from some fairly important detailed changes in bearings and in the alloys from which the bearings are made.

The *Merlin* still remains a 27-litre engine. What that means can be conveyed vividly by recalling that the Wright *Duplex Cyclone* has a volume of 46 litres, the *Cyclone* has 43 and the Bristol *Hercules* has 38.5. All three use two-stage super-charging but no intercooler. The new *Merlin's* merit, therefore, is seen to consist not merely in the small frontal area, which the liquid-cooled type whether Rolls-Royce or Allison can give, but in making intensive use of a limited volumetric capacity. It looks rather like the inverted miracle of taking nearly a quart out of a pint pot.

What this means to the *Spitfire* will be told some day in precise terms. For the present we are all left to draw our own conclusions, but we are helped in drawing them by reminding ourselves that the *Spitfire IX* is a match for the Fw-190 and that the Fw-190 has a top speed of 390 m.p.h. at 20,000 feet and a service ceiling of 37,000 feet. What the *Merlin 61* might mean to other aeroplanes now on the stocks can be gauged from these facts.

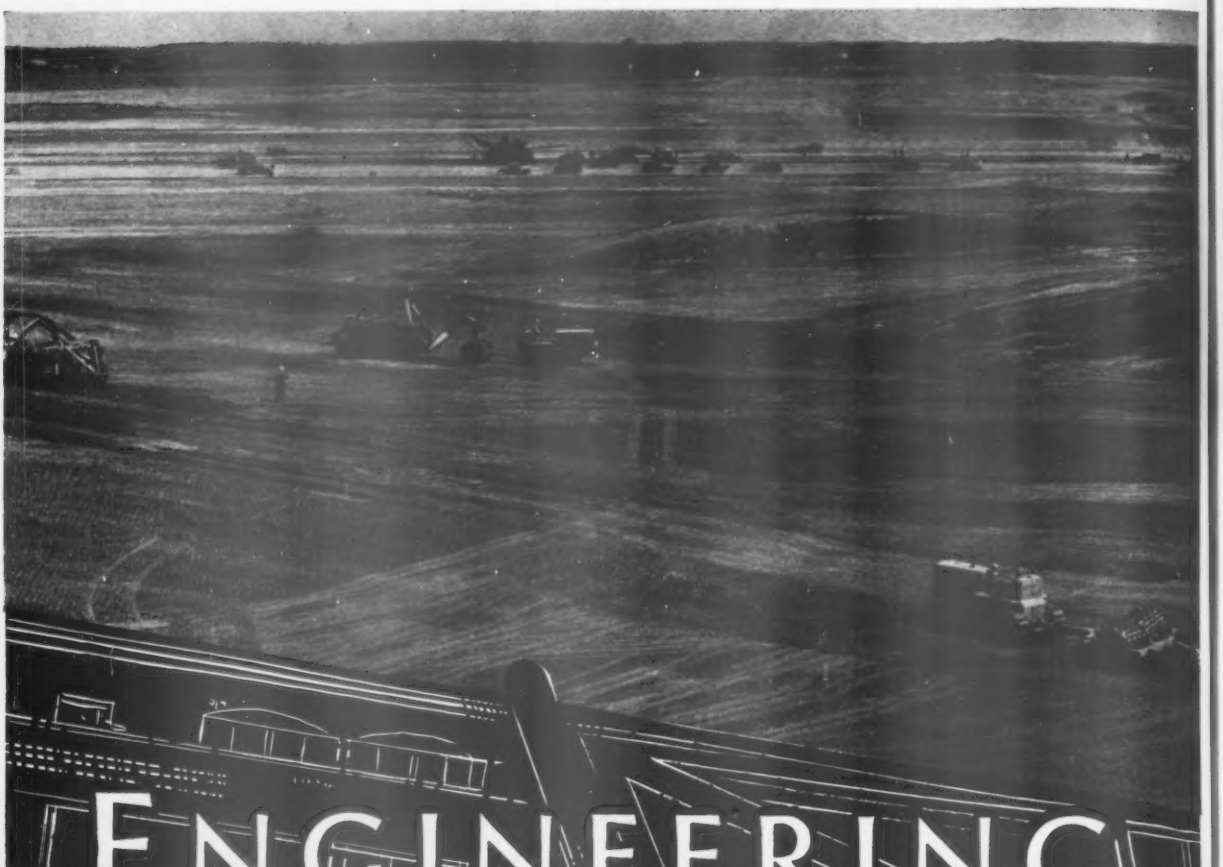
In Great Britain, where *Merlin* production is on a huge scale, the advantage of so large an increase in power without needing to re-jig and re-tool to get it is obvious. On a lesser scale the benefit will presumably transfer itself to the United States now that Packard production of the *Merlin 20* is in full swing. We in this country have had excellent service from the earlier marks of the *Merlin*. On the bomber side it has helped the de Havilland *Mosquito* and the Avro *Lancaster* to success. The latest mark of *Merlin* could plainly give those bombers better speed and higher ceilings.

(*Continued on page* 158)

The new Rolls-Royce "Merlin 61" gives a 50 per cent increase in power output over "Merlin" used in the earlier "Spitfires." W. Elliott, its designer, is at lower left.

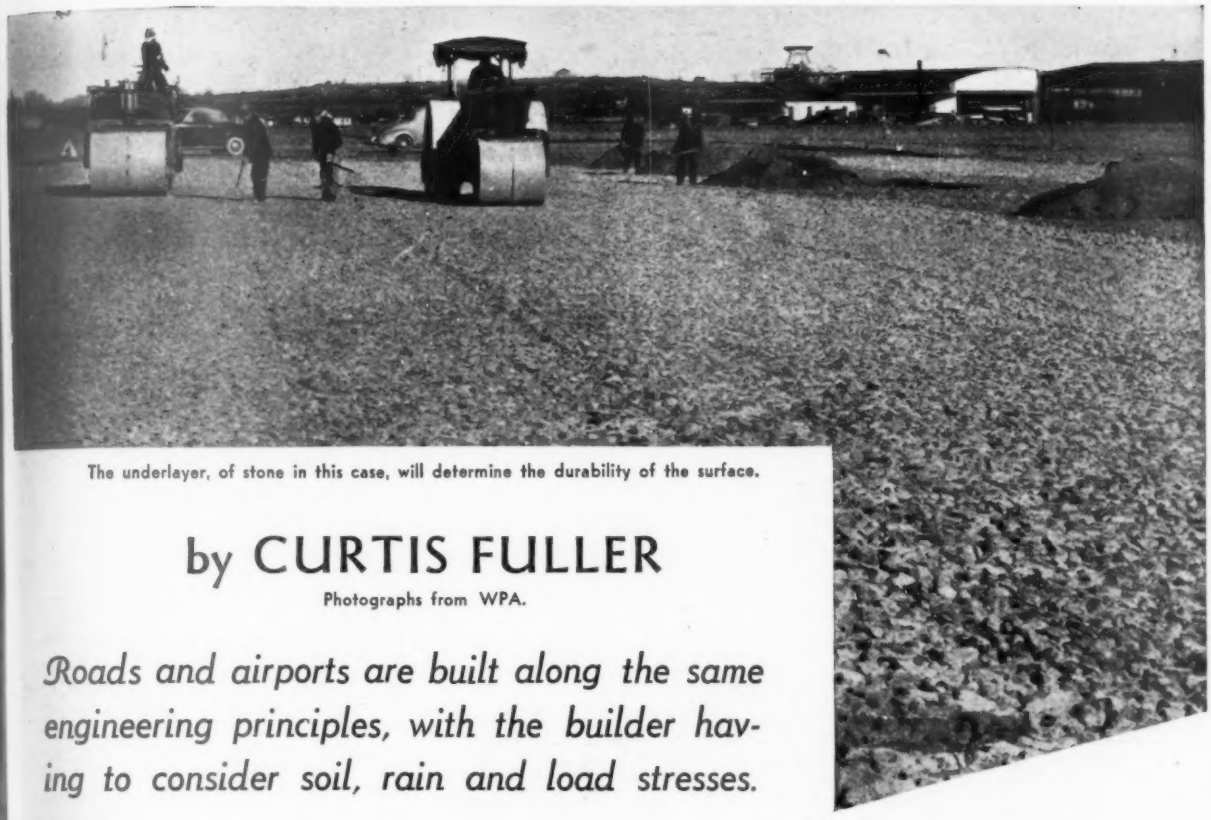
British Combine

* "Report From Washington," FLYING'S special monthly feature, appears as an exchange column in "The Aeroplane."



ENGINEERING AN AIRPORT

Giant scrapers and sheepsfoot rollers carve an airport somewhere in the United States.



The underlayer, of stone in this case, will determine the durability of the surface.

by CURTIS FULLER

Photographs from WPA.

Roads and airports are built along the same engineering principles, with the builder having to consider soil, rain and load stresses.

IF he could come back from the 18th century, the famous old roadbuilder, John L. McAdam, who gave his name to macadam roads, would stand with his mouth agape at modern methods of construction. But if he stayed long enough on this terrestrial sphere, he would discover that his basic principles of 150 years ago are still used in building grades for four-wheeled vehicles—or aircraft.

McAdam's main thesis was simple: The weight of wheeled vehicles is not supported by any amount of pavement or gravel or anything else that is placed over the traveled way, but by the natural soil itself. And if it is properly drained, this natural soil is capable of supporting any load that will normally be placed upon it.

With a few refinements this is still the basic principle of constructing traveled surfaces, whether for the wheels of wagon, trucks or heavy bombers.

Modern soil science, developed within the past few years, has discovered that McAdam's idea that the soil itself has to carry the load of traffic can be improved upon to this extent: ideal mixtures of soil can carry the load a lot better than haphazard mixtures.

Therefore, modern airport designers are spending a great deal of care obtaining these ideal soil mixtures for the bases over which they now find a thin skin of asphalt or concrete is adequate for the anticipated 150-ton aircraft of a few years hence.

Runway design breaks itself down into the three main components of drainage, base stabilization and surface construction. The building of airport runways differs only in detail from highway building except that it is somewhat ahead of the latter. The modern methods now used in building runways will probably be used more widely in building roads after the war.

First is drainage. The culverts and drains used in runway construction must be able to withstand harder impacts than they are likely to receive in road construction. When the port is first laid out, a good drainage system should be based upon maximum anticipated expansion or it may have to be remade when runway growth sends too much water pouring off the surfaces for the drains to handle.

Drainage includes both surface and subgrade drainage. The surface drainage system is usually considered adequate if it can remove all the surface water within two hours after the second-heaviest rain of the year ceases. Drains should be ample enough to handle all the water that falls on the surface at the rate of 1.8 inches per hour for the Gulf states, 1.4 inches per hour for the other southeastern states and one inch per hour for the remaining states east of the Rocky Mountains. On bituminous or concrete-surfaced runways, about 90 per cent of the rainfall flows into the surface drainage system.

Drainage of the subgrade is perhaps more important than surface drainage, and often much more difficult. The presence of large amounts of water might make the entire subgrade soft and unstable and cause the surface to disintegrate. Even small amounts of subsurface water can cause frost boils, soft spots or other weaknesses which could wreck a plane in a flash.

An unusual job of subgrade drainage was required recently on a huge four-square-mile airplane repair base in the Pacific Northwest. Covering this area was a surface of windblown soil, one formation of solid rock, and a number of small, innocent-looking lakes and swamps. Inspection revealed that the lakes and swamps were fed by underground streams and had wet blue clay bottoms which were unsuitable for foundation material.

Engineers on the job had to chart the underground streams back to their sources and either stop or divert them. Then channels had to be dug to drain off the surplus water. The blue clay bottoms were excavated down to the clean sand and gravel underlying the entire area. Into the former lake beds were placed perforated pipe, arranged in herringbone pattern. The whole pipe layout was covered with stone crushed from the blasted-out rock outcroppings elsewhere on the airport site. The pipes were connected with a system of larger pipes which led to a ditch outside the bounds of the airport. Finally the balance of the excavations were filled with other material scraped off in levelling the port. A tremendously costly job, all this, but

(*Continued on page* 150)

Flight in Nature

by

FRANK W. LANE

Photographs from Acme

Nature's expert on formation flying is the goose.

IT is said that the Wright brothers used to lie on their backs upon the sands of the North Carolina coast and gaze for hours at the flight of the turkey vultures. It was probably a result of what he learned then which caused Wilbur to say in a lecture: "The bird has learned the art of equilibrium, and learned it so thoroughly that its skill is not apparent to our sight. We learn to appreciate it only when we can imitate it."

From the time of the Wrights down to our own day, natural flight has interested and evoked the wondering admiration of the aeronautical engineer. And let no one think that in times of war we can let up on such a study. Just to show what our enemies are thinking of this subject here is an extract which appeared in a German technical journal last year. It is taken from a report of two research workers and they say: "A closer study of animal flight would reveal new and important ways of using atmospheric forces. Some experiments, about which we are not at liberty to speak, are the best proof of this supposition."

It is when the performances of which birds and insects are capable are studied that you realize just how far we lag behind these real masters of flight. We hear enough about what the latest aircraft types are able to do—look for a moment at some of the feats which Nature's models accomplish in more or less routine flying.

Some birds of prey can lift and carry for short distances weights equal to or even in excess of their own weight. It has been computed that the golden plover can fly 2,400 miles in 48 hours on a fuel consumption of less than two ounces of body fat. If airplanes could attain a like economy, they could cut their fuel consumption to one-eighth of that used at present. Prof. Melvill Jones has calculated that if the efficiency of the modern airplane was as great as that of the albatross only one-third of the present horsepower would be needed to drive it.

Birds can land almost vertically and most of them require no preliminary run.

In comparison to the bird and the insect, the airplane is a clumsy, wasteful machine. Although we have learned much, nature still holds many secrets.

The ugliest of birds, the pelican is one of the best flyers. Notice the wide wing span.

Similarly, in taking-off they can spring into the air and be ready immediately to fly in any desired direction. That amazing flyer, the humming bird, has been proved not only to fly backwards but to fly *sideways* as well.

It is significant that the humming bird beats its wings in a way which appears to be different from that of any other bird. Ultra high-speed motion pictures have shown that on each downward or backward stroke, the wings cross completely over, so that they are actually upside down. It has already been suggested that this remarkable twisting of the wing may be like the action of a variable pitch propeller. We wonder if a closer study of the humming bird's wing motion, say in a wind tunnel with apparatus to record the pattern of the airflow about the wings, would reveal further facts of importance to the designers of propellers?

In conversation some while ago with the chief designer of one of Britain's famous aircraft manufacturing companies, he spoke enviously of the wonderful structure of a bird's wing when compared with the comparatively clumsy wing of an airplane. The swiftest flying birds have wings which are beautifully adapted for mastery of the air. Streamlined, with a high aspect ratio and with little camber, they are ideal for swift movement through the air.

The strong bony keel near the front margin of the wing causes it, during the downward stroke, to "feather" itself and cut the air edge-on. The air is thus glanced in the required direction. The tail, too, plays its part in aerial maneuvers. Perfect muscular control (it has been estimated that a goose has 12,000 muscles to control the action of its feathers alone!) enables a bird to raise, lower, spread or alter the shape of its tail. It is used both as a balancer and rudder, aids in the difficult process of hovering, and helps to tail off the air stream.

Some birds, with long, deeply forked tails divided in two at the trailing edge, appear to use them at times much in the same way as a plane uses a Fowler flap, that is to give a larger surface, increase in camber and slot-effect causing higher lift, to the wing. The frigate-bird, which has an extremely long, forked tail, is reported to have been seen to rise suddenly without any perceptible motion of its wings but with its tail spread wide out.

An interesting feature about the wing of a bird is the safety-devices which are built into it. If a bird's wing is examined closely it will be seen that there is a little group of feathers, called the "alula" or "bastard wing," which is distinct from the main portion of the wing. Dissection shows that the alula is supplied with muscles which can cause it to spread when the wing is extended. Its effect when in the working position is to smooth out the airflow over the bird's wing. It is, in fact, an almost exact parallel of the Handley-Page slotted wing. Incidentally, when a fledgling bird first leaves the nest, the alula is the only part of its flying equipment which is fully developed.

In reading all the literature which has accumulated about bird structure and flight, one is impressed with the number of parallels which the avian world provides of some of our most modern, lauded aeronautical inventions. Some have already been referred to. Here are a few more. Looping-the-loop is supposed to have been first suggested to some pilots who watched the antics of tumbler pigeons. Dive-bombing might well have been learned from another pigeon, the "Oriental sharpshooter."

Pigeon-fanciers keep this bird in a loft

A golden eagle swoops low before grabbing his morning meal. This bird can fly on the level at 90 m.p.h. The bird also has been known to dive at speeds bettering 110 m.p.h.

Dr. Anna Platt snapped these photographs of a seagull hunting for a morning meal.

The gull has spotted his prey. Wings stretched, he glides in for a water landing.

Back-tracking with his wings and tail feathers spread, the gull drops straight down.

with a very large opening and in a place free from obstacles. Both these precautions are necessary in view of the thunderbolt-like tactics of the pigeon. When the fancier enters the loft he flips one of the sharp-shooters and it immediately "towers" to an immense height. When it is but a mere dot in the heavens the fancier signals by waving a large cloth or similar object.

On receiving this signal the pigeon folds its wings and falls headlong to earth. The bird soon reaches maximum velocity, and its tremendous swoop causes a shrill whining sound like the high-pitched note of a shell screaming through the air.

Did Immelman learn his famous "turn" from a study of bird flight? He could have done so, as witness the following account of an incident which a correspondent of mine saw in an English country lane. A sparrow-hawk was seen flying at full speed after a finch which was already crying out in the black minute before capture. But it managed to escape by diving under a huge wall of telegraph wires and found sanctuary in some shrub. The hawk, with no eyes for anything save its victim, suddenly found itself hurtling into the bank of wires which would have cut it to pieces at the rate it was travelling.

To save itself, the hawk shot straight up into the air like a rocket, turned into a half-loop, rolled over at the top of the turn and flew back the way it had come—thus performing a perfect "Immelman turn."

During a lecture tour last year of some of the RAF stations I mentioned some of these parallels between airplanes and bird flight. After one lecture, a squadron leader came up to me and told me of something he had noticed while he had been stationed at Cranwell where much training was carried out before the war. He said he had noticed that some of the birds there had flying stunts all their own and he wondered if they had been trying to copy some of the weird gyrations gone through by some of the pilots in training. To my gentle suggestion that I was not as green as I looked the squadron leader said he was quite serious.

Some years ago members of the RAF were asked to report any interesting data concerning bird flight which they might obtain as a result of their flights. Some interesting results were obtained, although I'm afraid all the pilots canvassed did not take the suggestion with the seriousness that was intended. One pilot, for example, reported that he had met a flock of forty cock ostriches cruising at 17,000 feet!

But fortunately, not all the RAF pilots took the suggestion so facetiously. Among the more serious-minded, incidentally, was one C. Portal who is today Sir Charles Portal, Air Chief Marshal of the RAF. Sir Charles is a keen falconer and has contributed a number of interesting observations on the speed of birds to ornithological literature.

From the observations made by the RAF pilots and other observers much is known today about the speed of birds. But the layman is apt to go astray on this subject because he often fails to appreciate what is obvious to the air-minded man—namely that air- and ground-speeds are two different things. Ideally, all the timing of birds in flight should be done from the air and in the following list all the speeds in miles per hour, have been obtained by observance from aircraft.

Partridge, 40; brent goose, 45 (another record gives 60-70); gannet, 48; lapwing, 50 (another pilot reported that one of these birds kept up 60 for several miles); snow goose, 50 (bird was being chased); swan, 55; Canada goose, 60 (chased); mallard or wild duck, 60 (for 10 miles); pintail, 65; teal, 68 (chased); canvas back duck, 72 (chased); golden eagle, 90 (other timing indicates that least 150 can at times be reached by this bird—especially with the aid of gravity); American cloud swift, 95 (this bird circled a plane travelling at 85); lammergeyer or great bearded vulture, 110 (this bird was diving); swallow, 150 (I include this

(*Continued on page* 160)

TOMORROW—

AS AN AIRLINE PILOT SEES IT

M. Charles Linke

By Capt.
FRED SMITH

A multitude of problems must be solved if we are to cope successfully with the air traffic to come. This practical airman reviews today's operating faults.

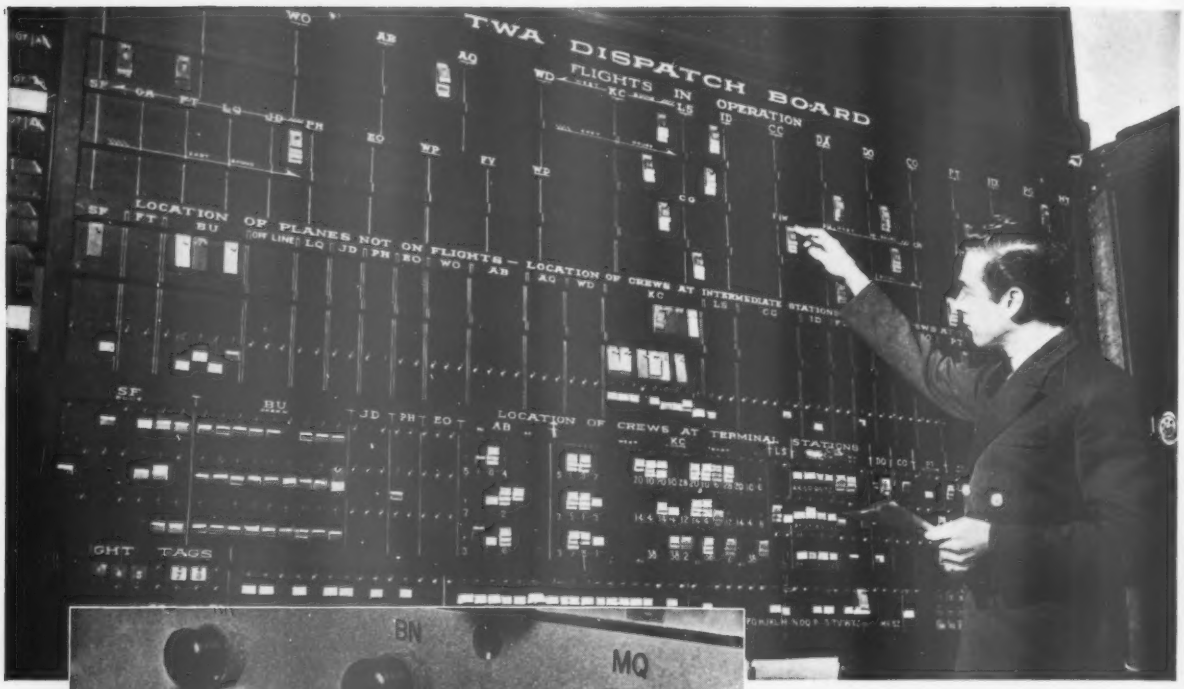
CENSORSHIP, policy and normal precaution prevent writing of the serious problems confronting contemporary air navigation, but there seems to be no good reason why a look at tomorrow's is out of place. Certainly it is universally conceded (among our airmen) that the numbers, types and purposes of aircraft in the skies of 1950 will call for the most lucid research in today's laboratories, and past solutions—practical in the years gone by because they were in the hands of highly trained flight personnel—must be resolved and simplified for use by the thousands who will fly the skies.

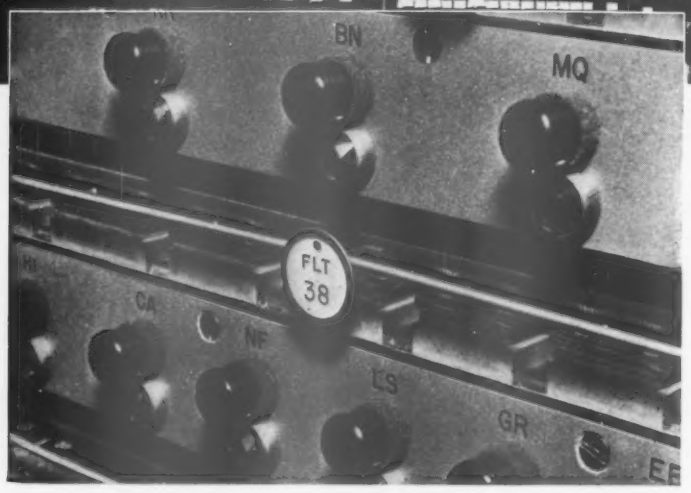
One of the most acute crises ever encountered by scheduled airline operators —that of traffic congestion over and around metropolitan air terminals—was sublimated temporarily when December 7, 1941, appeared on the calendar. The dispersal of concentrations of commercial airliners to wider areas furnished, at least for the time being, a breathing spell for harassed operations, airways traffic and regional CAA supervisors, all of whom were handling this "hot potato" whose temperature was in the ascendant. And still is, because all of these men realize that the problem is returning with each passing day's expansion of military and commercial use of the airways. At New York, Chicago and several other terminal cities, it would not take much more traffic to thoroughly swamp the present system of airplane segregation during periods of poor flying weather. Adding to these difficulties the problem of obtaining properly qualified personnel to man the airways traffic control centers, one can imagine the vitally serious aspects of the entire picture. For every pilot using the airways in 1941, it doesn't seem unreasonable to predict that there will be at least 100 in 1950! The quotation applies: "After that, the deluge!"

Inklings have been heard that capable men are actively engaged in evolving a solution. At least one manufacturer of business machines is working on a block system aircraft "separator" to reduce the three-dimensional octopus to a slide rule basis. In their designing of this device, it is prayerfully anticipated that the temperaments and muscles of the pilots, who will take off, approach and land under its control, will behave as proper factors in a slide rule calculation should. The writers, drawing upon a dozen years' close observance of the problem as it grew, believes that they will *not*. Further, it is the considered opinion of many career pilots that the lack of a sane solution could, in the future, absolutely preclude profitable operation of airline schedules.

The present system of aircraft segregation within 25 miles of terminal airports is, in actuality, a very vague proposition. Happily, pre-war aircraft saturation of these areas never *quite* overloaded the system, though there were many occasions when it seemed that the breaking point was near. I can remember, for instance, one early spring evening two years ago when more than a score of ships were circling the various "holding" points, "stacked" to 11,000 feet! Fortunately the icing conditions that prevailed that night were such that, by "cheating" a little (that is—by holding 7,300 feet altitude instead of the prescribed 7,000) the icing layer could be avoided (similar discrepancies also being employed by other pilots at other altitudes). A holding point (the intersection of two beam legs, or the area wherein a fan-marker signal can be heard) is extremely indefinite as regards a precise location. This quality pervades throughout the entire procedures, producing an elasticity in arrival-times not conducive to efficiency.

Ask any chief pilot charged with the training of airline pilots how truly "standardized" his men are, and he will


TWA DISPATCH BOARD
FLIGHTS IN OPERATION
LOCATION OF PLANES NOT ON FLIGHTS — LOCATION OF CREWS AT INTERMEDIATE STATIONS
LOCATION OF CREWS AT TERMINAL STATIONS



A conventional manual flight control board, above, now used by many airlines. At left is TWA's automatic block system. Disc shows position of each flight in relation to sections of route, designated by code letters.

truthfully tell you that it is a rare occasion when any two of his men fly exactly alike, even though they were carefully trained in the same school and had the same equipment and teaching. An operations manual merely sets forth the approved *method*, in detail, for making instrument approaches.

It can never anticipate or prevent the personal idiosyncrasies of the individual pilot, and within these peculiarities lies the other great variable in our present traffic control system. One pilot will take a circular area one mile in diameter to accomplish a "timed turn" when flying on instruments; another, in identically the same kind of plane—will use a 1½-mile circle. Each of them, while making his respective turn, also has to reckon with the third dimension—altitude—and the discrepancies increase again because of their technique, the loading of their planes and local atmospheric conditions such as turbulence, wet cloud (which requires carburetor-heat with resulting change in power output) and a dozen other items not available to a slide rule.

With these factors in mind, where lies tomorrow's solution? What new instruments are required to solve the impending muddle? It is believed that proper instrumentation can do it!

In the airplanes concerned, precise control of altitude must be obtained mechanically by adapting the automatic pilot to barometric control, for maintenance of a prescribed height above sea level within 10-20 feet. Standardized rates of ascent and descent within safe performance limits of the aircraft can similarly be incorporated, using this control. Air speed *must* be standardized at a rate suitable for all airports on a national basis, and automatic power or throttle manipulation to maintain this air speed must be incorporated.

Some kind of *visual* indication of terrain must be made available to the pilot so that he can hold his plane over a prescribed point while awaiting his landing orders and, further, the robot pilot must be adapted to keep the plane in a standard turn while so holding.

If these prerequisites are met in tomorrow's planes, much of the problem is licked, assuming that there will be alternate airports available in the metropolitan areas. There is a very important feature, however, that must be uprooted from its present conception, and that is the means by which the airways traffic office for each area does business.

Principal bugaboo in today's airways control is the matter of communications. Airliners, military planes and the occasional itinerant now enjoy the use of a very few frequencies (and these are jammed to the gunwales at this very moment). It is to be hoped that the use of extremely high frequencies will eliminate this congestion and that the development of devices employing electronics will reduce the use of the spoken word to a minimum, supplying to the chief controller of each traffic area a *visual* picture of what is going on in his bailiwick, rather than a clumsy, relay-cluttered acceptance of the aural message from a busy pilot. The control office of tomorrow's airways traffic centers then will emerge from the present confusion and babel to become a sound-proofed dome not unlike a planetarium, with an H. G. Wellsian superman seated in its center, a ghastly reflection from a monster cathode ray tube shining upwards in his face and the walls of his "hemisphere" dotted with the projected positions of the planes in his area, *true* as to altitude, holding "fixes," and approach-sequence.

END

PILOTS' HEALTH COMMANDMENTS

by ALMA HEFLIN McCORMICK

In the words of the layman, a pilot writes on the importance of health.

EVERY pilot messes up a landing occasionally, and I had been flying hard the past two or three days. But when every landing was either pancaked or bounced, I turned in my parachute and reported to the CAA doctor.

He checked me over quite thoroughly. "Today you wouldn't pass for a private license," he said. "Not eating?" That was about the size of it. I was doing production testing on the "Grasshopper Squadron" lightplanes, flying hard and usually too tired to eat much but quick sandwiches and malted milks. The doctor brought out some vitamin concentrates: A for vision, B for appetite and nerve tone. Increased food consumption would care for the others.

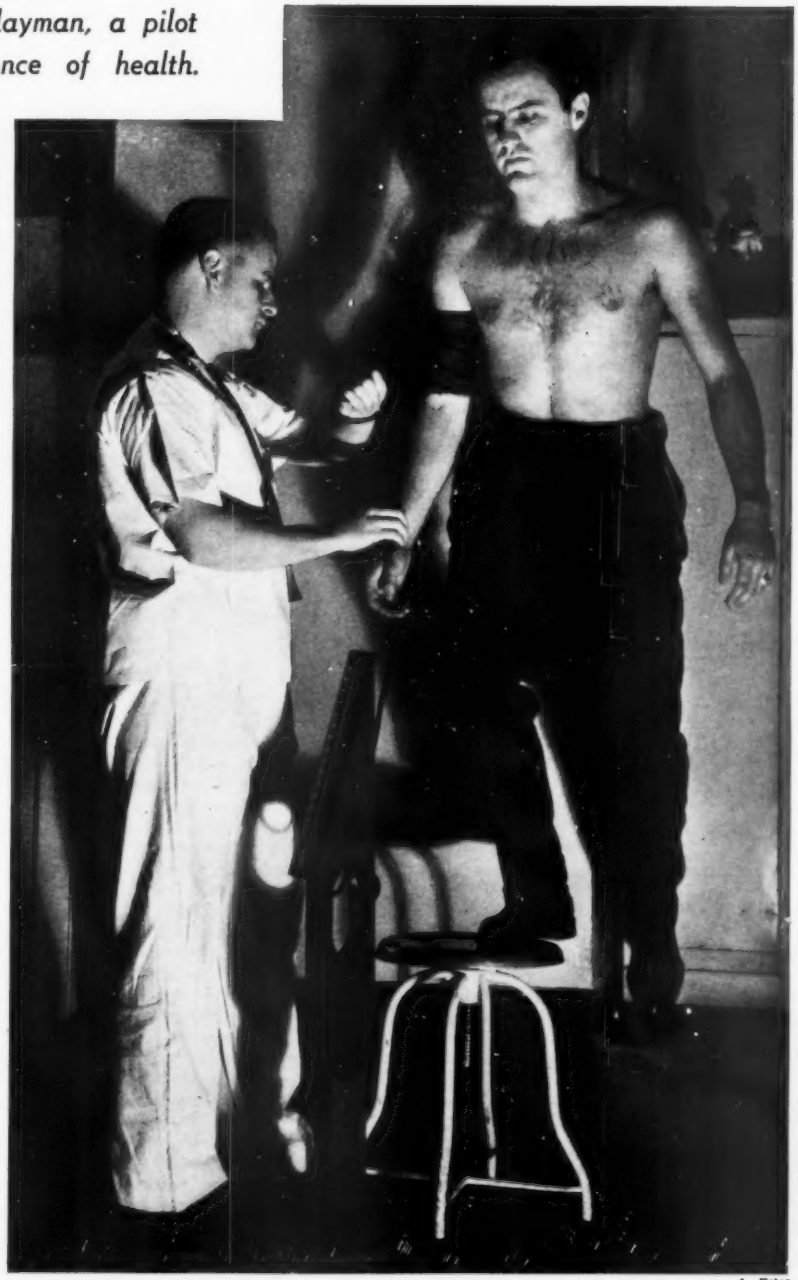
I reported for re-examination 48 hours later. Vision that had been a fuzzy 20/30 was a sharp 20/16, and diplopia—a tendency to blurred "double-vision"—was gone. Tremor was gone. I qualified again for a commercial.

It was not surprising to me. For a time, I had worked for a CAA flight surgeon. I had watched a number fail the examinations but correct the deficiencies and pass.

The disqualifying defects were chiefly due to functional disturbances, including excitement and/or fatigue; correctible physical deficiency or abnormality, or to deficiencies which, for the military forces, were not correctible.

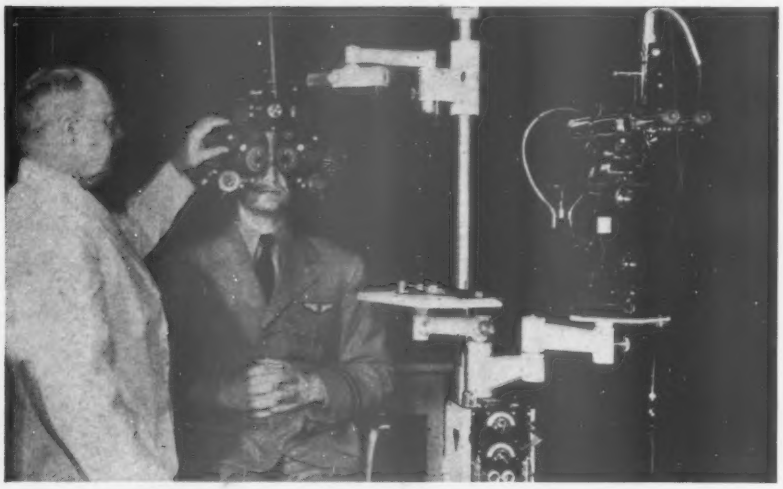
The Schneider index and the eyes gave the first indication of trouble when a candidate reported either too tired or excited. The index indicates circulatory efficiency. The basic pulse rate and blood pressure, the rate following exercise, the recovery after rest—all are given weight values and combined. The resultant figure may be minus, or may be as high as 18. If as low as 8, a pilot is not disqualified on that alone, but has little chance. The effect of fatigue and emotion on circulatory efficiency, however, can give as bad a score as actual physical shortcoming.

There was the fellow, for example, who



The Schneider index test being given by the doctor reveals circulatory ills.

A. Eriss



Dr. A. D. Tuttle of United Air Lines uses the refracting and muscle balance tester during one of the 20 steps in making a complete check on an airline pilot's eyes.

had driven up to New York City from Georgia. He came in obviously tired, over-excited, under tension. His blood pressure was up, his pulse high, his hands sweating, depth perception and visual acuity bad. He had flunked the Army Air Force exam in the psychiatric section. The boy had been arguing over flying. His attitude held bravado and childish swagger when he spoke of it. He had been turned down—emotional instability.

"Why do they think I'm joining up?" he said irritably. "Don't they want fighters? I can't get a break."

He had driven practically non-stop from Georgia. He was tired. His resentment and anxiety were reflected in his blood pressure, pulse and by sugar in his urinalysis. The glare on the highway had affected his vision. The doctor suggested that he rest and return again.

On his next visit he passed easily. The doctor lectured him on taking life more calmly. A swaggering, hot-tempered youngster has no place in modern "team" fighting if the emotionalism cuts the deadliness of his crew. Further, emotion can affect the body seriously.

Blood pressure and heart action are often the first to show effect, with the heart sometimes showing apparent disease. Digestion may be badly upset. A flyer worrying over long periods, even though he hides his worry, may not only reveal his disturbance in an exam but may develop hyperacid stomach with alternate diarrhea and constipation, nausea, occasional vomiting, belching, a decided or a vague burning pain. Such hyperacidity may end in ulcers. Due to distention of the stomach at high altitudes, especially after eating foods which form gas, hemorrhage may occur, making the pilot completely unable to handle the ship.

The pilot who can take a philosophical view of life usually comes through an examination better, and flies more efficiently. The importance of peace of mind is emphasized by the Army's reluctance to accept for flight duty a man whose family worries badly about him. Every pilot occasionally meets situations in the air when subconscious concern for a worrying family may be the last straw. Such emotional distress may be the root of various disorders . . . vision, gastrointestinal, circulatory, psychic headaches (much like migraine) and sapped nervous energy.

If the candidate finds himself apparently in good health, yet unable to lick such symptoms which may hazard either his chance to fly or his skill, it may be well to go on a psychic search for the trouble. Perhaps he will discover that he actually is afraid of the air and is flying to prove he isn't. Perhaps he has a nagging wife. Perhaps he is flying too much. Perhaps he is worrying about the examination. If he cannot discover the reason himself, a good psychiatrist can help him and perhaps save first-class pilot material.

Physically-based disabilities are often less discouraging because of easier diagnosis. About 62 per cent of all rejections are on eyes. If the trouble is color blindness, there is no help, as color vision is imperative for reading signals and judging terrain for landing or bombing. There is a rumor that contact lenses (the lenses fitted and held directly to the eyeball) may soon be acceptable. At present, vision that needs correction disqualifies a candidate for the Air Forces because of the danger of loss or breakage of the glasses in flight, endangering the mission the crew was sent to perform.

If because of eye structure itself the vision is defective, then little can be done. Sometimes the defect is one of weak and improperly balanced muscles. Such trouble may result in poor fusion of the images combined by the two eyes for a sharp "stereoscopic" image. This trouble is "latent diplopia" (manifest diplopia is the condition of crossed-eyes). Most people have such a tendency when fatigued, and it is the examiner's task to make sure the candidate does not have it to a degree which would become serious in flight. A physician trained in orthoptic correction can sometimes prescribe exercises to bring muscles to normal tension. Surgery sometimes helps.

The Richard Hudnut DuBarry Salon in New York City has had some rather surprising results in their classes. Their supervising physician prescribes diets that are well-balanced in food substances, caloric content and vitamins, and among other exercises their clients spend an hour or two daily lying in what they call their "beauty angle" with feet and hips elevated at 45° to send nourishing blood into the upper part of the body.

Whether the results are from the diet with its rich vitamin A content or from the beauty angle, or both, occasionally their clients find their eyesight improved from 20/30 to 20/20 or 20/16. Certainly deficiency in vitamin A (supplied by raw carrots, parsley, milk, butter, cream, concentrates such as halibut liver oil) causes night-blindness. A candidate having trouble passing his eye exam, or any pilot having trouble with his flying, might do well to consult an eye specialist and a physician well versed in dietetics before becoming discouraged.

The ear, nose and throat can cause much trouble for pilots. The main thing, within their control, is to see that the nasal and eustachian tubes are always open.

Adenoids may cause trouble because they may obstruct the eustachian tube. That will cause unequal pressure in the middle ear and at high altitudes may cause incapacitating pain or a rupture producing permanent hearing damage. Adenoids and diseased tonsils should be checked by the family physician and removed if necessary before the disappointment of failing a flight physical.

Candidates rejected because of their teeth sometimes become resentful. They "planned to shoot the Nazis, not bite 'em to death." The minimum requirement for teeth consists of six masticating and six incisor teeth, which must be properly opposed so that the pilot will have enough serviceable teeth to insure proper digestion. Beyond that, the teeth should have any necessary fillings or inlays before he reports. However, the requirement that causes resentment is usually the rule which disqualifies the candidate if he has gross malocclusion—that is, if his teeth are very crooked and his "bite" out of line.

There is good reason. Grossly malocclueded teeth set up an uneven pressure in the middle ear, especially at high altitude, that can create pain intense enough to cause fainting or serious inefficiency. If the subject knows he intends to fly when he still is of high school age (or later, if he has time), a good orthodontist can reshape his whole jaw-line. On an adult this process may take three or four years. If the malocclusion is caused by an uneven surface which leaves bad gaps between the teeth, a dentist can build inlays on the natural teeth to make the "bite" interlock properly.

If the candidate has good teeth, he can save them and prolong his flying usefulness by careful attention to diet and by proper oral hygiene. For example: brush-

(*Continued on page* 154)

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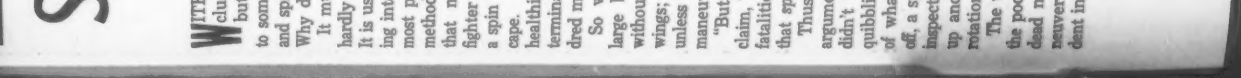

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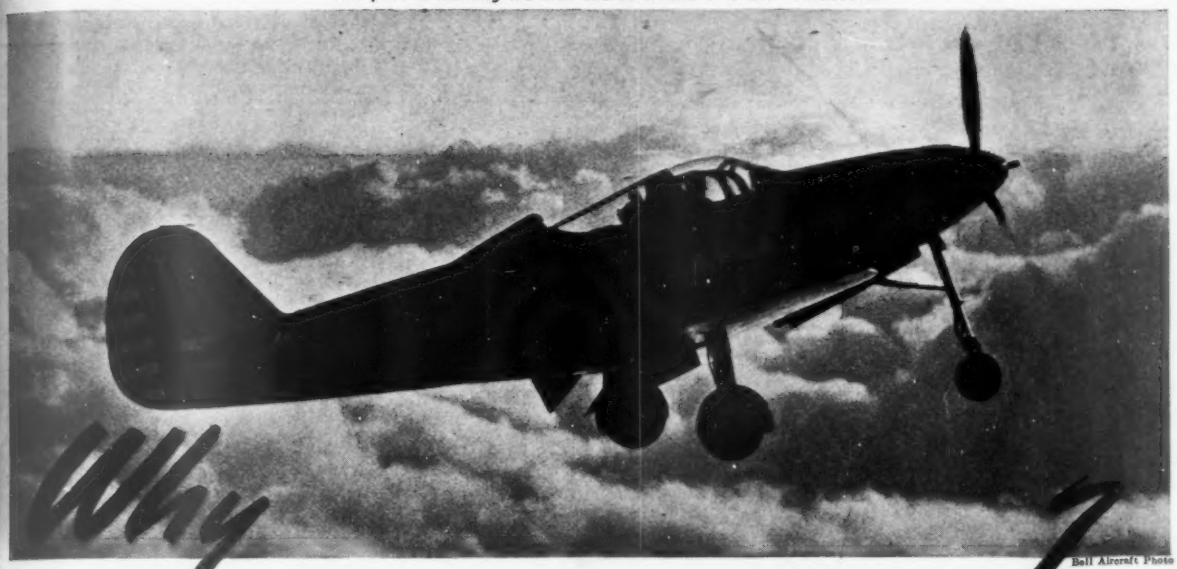
This pilot is learning the stall characteristics of a Bell "Airacobra."



Bell Aircraft Photo

Why STALLS AND SPINS?

by JOHN R. HOYT

Contraptions can be invented to warn the flyer in the event of a stall or a spin, but it is better for pilots to rely on what practice teaches.

WITH everything going modern, including not only techniques in flying but the planes themselves, it occurs to some of the newcomers that the stall and spin are passé. Why practice stalls? Why do spins?

It must be admitted that the stall has hardly any place as a military maneuver. It is used by some pilots just before rolling into a dive bombing attack, although most pilots prefer the frontal push-over method to the roll. The spin is a trick that might fool an enemy, but most fighter pilots laugh at this and claim that a spin is an unconvincing method of escape. It's much more reliable—and healthier—to dive away, provided the terminal velocity will yield a few hundred miles per hour in the way of speed.

So why practice stalls or spins? A large bomber can't be stalled or spun without something happening to the wings; and even a lightplane won't spin unless it is literally forced into such a maneuver and held there by brute force.

"But," a thousand pilots at once exclaim, "the CAA reports show that many fatalities occur each year from planes that *spin in*. How about that?"

Thus we have the basis for a first class argument. To begin with, those planes didn't "spin in." That is, unless we are quibbling by calling the first quarter turn of whatever a plane does when it falls off, a spin. A spin isn't a spin (the CAA inspectors claim) unless it actually winds up and turns at least one full 360° of rotation.

The trouble with that argument is that the poor pilots who "spun in" are just as dead no matter what we call their maneuver. Let's pick up some CAA accident investigation reports at random from the files and see what we draw:

". . . took off from the airport about sundown in a routine practice flight. After climbing erratically and steeply to about 200 feet, the pilot attempted a steep left turn. The plane entered a spin to the left and crashed in a nose-down position."

Here is another, in similar vein: ". . . partially opened the throttle and executed a climbing left turn, downwind, over wires bordering the eastern edge of the airport. After clearing the wires, the aircraft settled rapidly. In order to avoid an obstruction, the pilot pulled the nose up sharply, whereupon at an altitude of approximately 75 feet, the aircraft was stalled. It fell off to the left, through a power line, striking the ground just east of the airport."

"*Probable cause:* Loss of control during maneuvers at low altitude."

In the second instance, no spin was mentioned, but the spin was actually incipient. Let's call it a stall, though, for accuracy's sake, and go on to another example, chosen at random from the hundreds in the files:

". . . on the last take-off Pilot B. held his plane on the ground for an abnormally long run and when it left the ground, climbed steeply. At an altitude of approximately 100 feet, the pilot attempted a sharp left turn, during which the plane was stalled. It fell off to the left and struck the ground just as it was beginning to spin."

"*Probable cause:* Stall and spin at an altitude too low to permit recovery."

It is this "verdict" that gives the clue to the whole thesis of this article. It was written by the Civil Aeronautics Board, and is very pertinent: the plane was stalled, fell off and hit the ground just as the spin began. In other words, the spin was incipient, or just beginning. Finally, there wasn't altitude enough to effect a recovery.

Let's take one more, just for good measure: ". . . Pilot S. took off into a gusty wind, the velocity of which was estimated at 30 m.p.h. When the aircraft had reached the end of the field and had attained an altitude of approximately 150 feet, the pilot attempted a steep left turn, during which the aircraft was stalled. It fell off to the left and completed about half a turn in a spin before it nosed into the ground and burst into flames."

"*Probable cause:* Stall during a steep turn immediately following take-off."

There we have a group of accidents

When banking, all airplanes have higher stalling speeds than they would have when in level flight.

Vultee Aircraft Photo

resulting from stalls, all of them unintentional, all of them different. Some were the result of skidded turns, all of them spun into the turn (indicating they were skidded and that "top" rudder was not held), one was in turbulent air. What would you say was the fundamental reason for these crashes?

It would seem that first of all the pilots were not sufficiently aware of the stall. That may sound silly, but the fact remains that of the four senses which should have been trained to be acutely aware of the stalled position, not one telegraphed that message to the brain! So each pilot was not acquainted with the stall, or the conditions accompanying it.

It would seem in the second place that his recovery from stalls was either poor, or he had insufficient altitude in which to recover from his stall or spin (call it any name that is applicable!). The irony of it is that most of these things happen at altitudes at which the best spin recovery technique known wouldn't help much.

The fact remains that crashes are occurring every day from stalls. Let it be pointed out here and now: as long as present knowledge of the science confines us to the production of aircraft that go up because of lift obtained from an airfoil, we will have conditions of stall or semi-stall. Even the planes designed not to spin or stall will approach a point where the lift is not enough to hold the plane aloft—and the rate of descent will be great enough to jar the gold out of one's molars if it continues until contact is made with the ground.

So if planes (as we know them) will stall, or approach a stall, we must know this fact: it requires *energy* to regain airspeed, and we regain it by losing altitude, getting speed and getting away from the stall. But here is the rub: the amount of altitude lost in regaining speed very often is more than the height above the ground. In that case the CAB gets out another report.

The amount of altitude lost depends upon the wing loading and the gross weight of the plane. A certain military plane requires several thousand feet of altitude in which to regain flying speed! That varies, of course, upon the degree of stall and how much speed has been lost. But the point is that even a light, conventional, low-horsepower plane cannot be "un-stalled" merely by application of throttle. Altitude must be lost because by transforming foot-pounds of energy into motion, the plane is accellerated to flying speed.

It should be clear by now that something must be done about these stalls. One inventor suggested a device that would ring a bell or jab a needle into the pilot (in a convenient spot, of course) when he stalled the plane. That would mean that any time the plane was stalled normally, even during a landing, the warning would be given. To this objection, the inventor had a disconnecting device, to be used prior to landing.

But such a device, if equipped with a disconnector, could be forgotten, and it would be during a moment that the device was not in use that an accident would occur. Also, stalls are not always normal. That is, a plane can be stalled by turbulent air: it may be stalled when the airspeed is far above the usual stalling point, either because the bump increases the G's, or wing loading, or because the plane flies through a negative gust and thereby loses flying speed. So in passing, it should be pointed out that while it is smart to slow down in gusty air, it isn't so smart to throttle back too much. Choose a happy medium.

Another way a plane can be stalled and still fool a mechanical stall detector is to put it in a steep turn. As readers of FLYING have noted from previous articles on the subject, a bank of 60° will be accompanied by a load factor of 2 G's regardless of the plane or the speed at which it is travelling. So a plane that is banked at 60° will stall at a higher airspeed than in level flight.

Obviously a mechanical stall detector won't work. There is one and only one good stall detector—the human brain. But in order to make the brain function it must be given a message, and four of the telegraph companies that do business with the brain are: the sense of sight, the sense of feel or touch, the sense of hearing and the deep-muscle or kinaesthetic sense.

Four of them—any *one* of which should be enough to detect an incipient spin, or stall! But even the best pilots will admit that they have difficulty occasionally in avoiding stalls, and that just because they once learned the procedure of stalls, spins and recoveries therefrom, is no reason for believing they are still proficient therein.

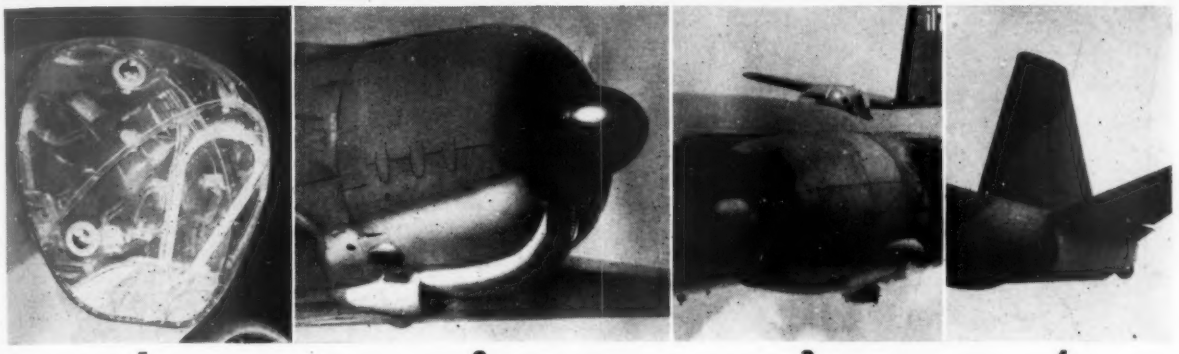
In short, it requires practice. It takes practice to learn a stall—and practice to retain that deep-seated awareness of it. Another point is that almost every single plane stalls differently from its sister, albeit the same manufacturer's plate graces the panel. That means a good pilot will learn the characteristics of his own plane thoroughly and review them frequently. It means that he will become acquainted with a new plane before doing any maneuvers whatsoever—and that means going up to a few thousand feet right after take-off and finding out what a stall feels like.

What does a stall feel like? Let's suppose you're a beginner again. You would be told there are three kinds of stalls, all of them valuable. First there is the approach to the stall. Then there is the full stall. Finally, the advanced stall.

The best two are the first two. They will develop all four senses to the point where an automatic warning will occur when the stall is reached, and this warning incidentally cannot be disconnected, nor will it jab you in an unexpected spot. Enter the stall by closing the throttle, easing the nose up to a landing position and holding it there. Then wait for the burble that will indicate the approach of the stall. When it comes, push the nose down promptly but smoothly, and form that habit of smart, prompt, precise recovery. That's what you are after—the warning of the stall, followed by immediate recovery technique.

(*Continued on page* 126)

FOR IDENTIFICATION



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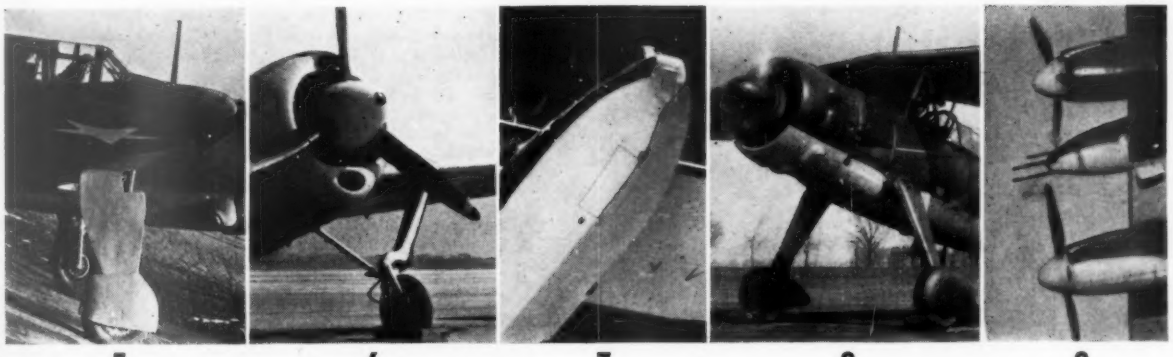
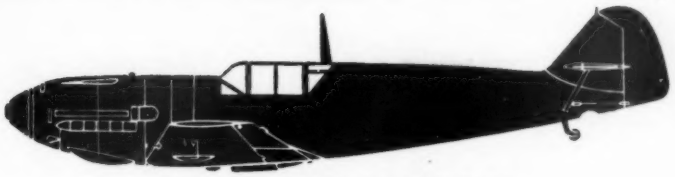


5 6 7 8 9

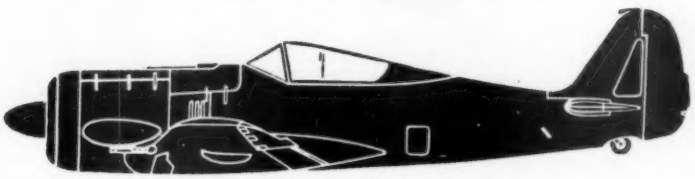
The planes are: 1. Boeing "Flying Fortress" (B-17F). 2. Mitsubishi Zero. 3. Martin "Marauder" (B-26). 4. Vultee "Vengeance" (A-31). 5. Curtiss "Helldiver" (Army A-25 or Navy SH2C). 6. Brewster "Buffalo" (F2A). 7. Consolidated "Catalina" amphibian (PBY-5A). 8. Henschel Hs-126. 9. Westland "Whirlwind."

MISTAKEN IDENTITIES

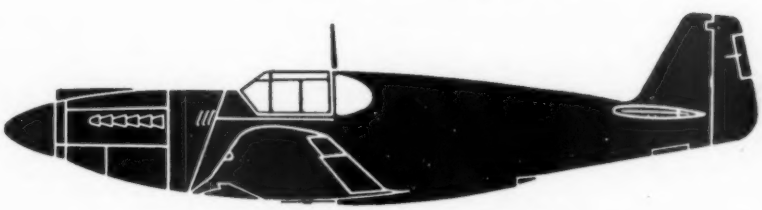
WHEN they are seen together there is no mistaking the Me-109E, the Fw-190 or the *Mustang*. But, in aircraft identification classrooms, they frequently are mistaken for each other. The three side views at right are shown exactly to scale, so that they can be compared for size as well as external appearance. Particularly careful examination should be made of the *Mustang* and Me-109E; the American fighter frequently has been mistaken for the Messerschmitt, mainly because of its square wing tips and tail, much like those of the Me-109E. This similarity is more clearly seen in the bottom views of the two types; they will be shown in this department in an early issue. The Focke-Wulf also has squared wing tips, but the overall appearance of this type has several pronounced differences. Of the three planes shown, for instance, the Fw-190 is the only one with an air-cooled radial engine.



Messerschmitt Me-109E. Length: 28 ft. 8 in.



Focke-Wulf Fw-190. Length: 28 ft. 11 in.



North American "Mustang." Length: 32 ft.

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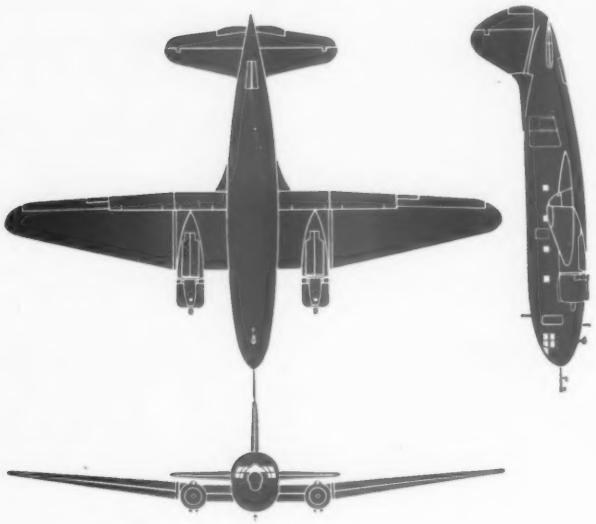
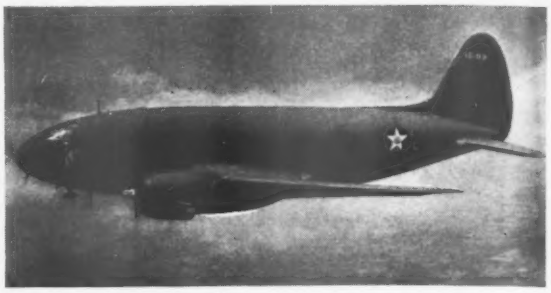
CURTISS "COMMANDO"

Transport





PERTINENT FACTS: Already making a name for itself comparable to the veteran Douglas transports, the Curtiss *Commando* (C-46 in U.S. Army, R5C in U.S. Navy) is in large-scale production. The *Commando* is carrying cargo to all parts of the world; certain U.S. airlines are operating them under contract to the Army. Powered with two 2,000 h.p. air-cooled engines, the *Commando* weighs 45,000 lbs. fully loaded. Top speed at optimum altitude is 264 m.p.h.; cruising speed is 195. It carries no armament. Wing span is 108 ft., length 76 ft. 4 in., height 22 ft. Prototype of the *Commando* was the Curtiss CW-20.

WHAT TO LOOK FOR: This airplane, at first glance, can easily be confused with the Douglas DC-3 (C-47 or C-53). On close examination, however, it differs materially. Like the Douglas, the wing is cantilever, has some dihedral and, in the bottom view, is strikingly similar. The *Commando* wing, however, has slight taper on its trailing edge, with sharp taper on the leading edge. The fuselage is unusually deep. Unlike the Douglas, the cockpit is part of the smooth overall contour and does not break up the symmetrical shape of the fuselage as a whole. The standard single fin and rudder is used. The trimming tabs on the elevator are unusual in that they bulge outward slightly. The landing gear retracts.

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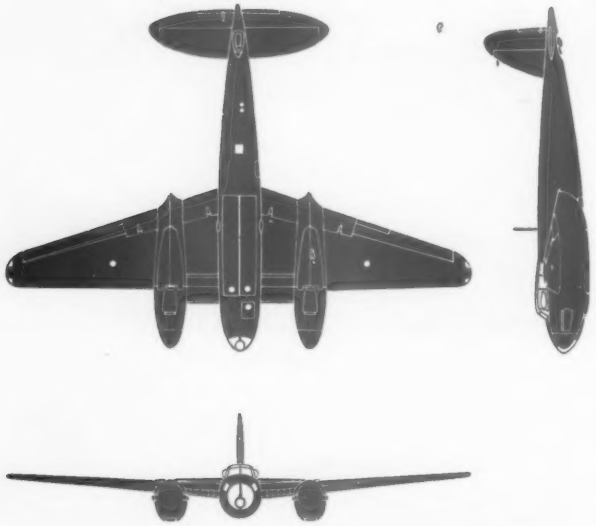
DeHAVILLAND "MOSQUITO"

Light Bomber



PERTINENT FACTS: A closely-guarded secret until recently, the *Mosquito* now is being widely publicized by the British as the "world's fastest and most efficient aircraft." Built almost entirely of wood, the *Mosquito* (De Havilland's Model DH-98) is in large production in Britain and near Toronto, Canada. Powered with two 1,280 h.p. Rolls-Royce *Merlin 21* liquid-cooled engines, the *Mosquito* is said to be as fast as most fighters. According to Allan A. Michie, in his book "The Air Offensive Against Germany" a *Mosquito* flew the 1,500-mile round trip between England and Genoa, Italy, in 3½ hours. If true, that's an average speed of 428 m.p.h. Primarily a light bomber, it is fast enough to be used for reconnaissance. Armament is optional; sometimes it operates unarmed, at other times it can be equipped with four 20 mm. cannon and four .303 caliber machine guns. Wing span is 54 ft. 2 in., length 40 ft. 9½ in., height 15 ft. 3 in.

WHAT TO LOOK FOR: A conventional-appearing mid-wing monoplane, the *Mosquito's* cantilever wing has pronounced dihedral from the fuselage outward. Installed in the wing's center section are the engines' radiators; in the bottom view they can be seen projecting ahead of the leading edge. The plan view of the wing resembles that of the Douglas *Boston* a good deal, having a straight leading edge and sharply tapered trailing edge. The engines are underslung, the tops of the cowls blending smoothly into the top of the wing. The fuselage is slim, tapering down to a point at the tail. The tail is the DeHavilland trade mark; rudder and fin are quite tall. The horizontal tail surfaces have wide span and are elliptical in shape. The landing gear is fully retractable; the tail wheel only partially. The cockpit holds two, seated side-by-side.

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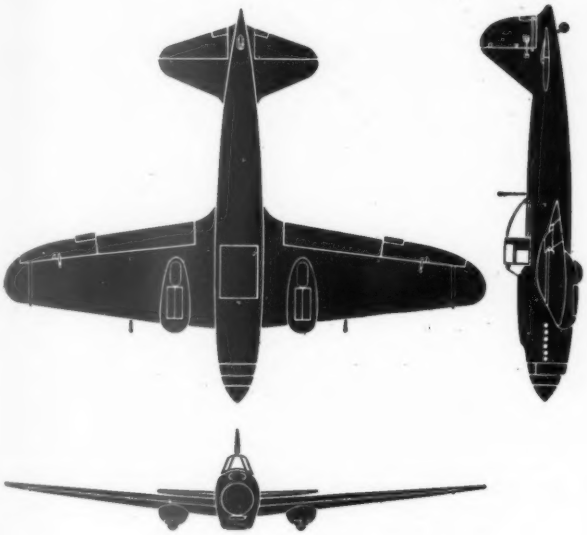
RUSSIAN "STORMOVIK"

Dive Bomber



PERTINENT FACTS: As is true of all Russian aircraft, hardly any specific data are available on the Stormovik or IL-2, as it also is known. What few reports are available, however, indicate that this airplane is a highly effective dive bomber and ground strafer. The single-place cockpit is heavily armored against light antiaircraft. A low-wing monoplane, it is powered with a liquid-cooled M-38 engine, of 1,300 h.p. One British report says its armament includes two 32 mm. cannon and two machine guns. The Stormovik is manufactured in a Russian State Factory. No further specifications are available.

WHAT TO LOOK FOR: The cantilever wing has moderate dihedral. It also has moderate taper on both leading and trailing edges, with pointed tips. The fuselage is thicker from the cockpit forward than it is toward the tail. An unusual-appearing feature is the cockpit itself; the canopy juts upward to a pronounced degree. The tail contains the standard single fin and rudder; the elevator and fin are sharply tapered. The landing gear is semi-retractable, though the tail wheel does not retract.

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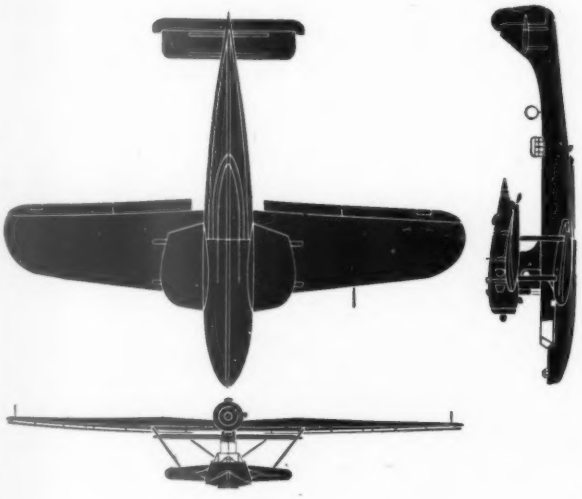
DORNIER Do-18K

Patrol Bomber



PERTINENT FACTS: This is Germany's standby flying boat. An old design, it has been used by the Nazis for years, dating back before the war. The photograph above is of the Do-18K, while the silhouette is of the Do-18K2. The airplanes are identical except for the fact that the K2 has 865 h.p. air-cooled engines instead of 600 h.p. liquid-cooled diesels. Before the war the Do-18 was used as a transatlantic mail carrier to South America. Span is 77 ft. 9 in., length 63 ft. 1 in., height 17 ft. 9 in. Top speed of the K2 is 186 m.p.h.; range is 2,700 miles. It carries two machine guns. Gross weight is about 15 tons.

WHAT TO LOOK FOR: The Do-18K is a parasol-winged monoplane, like the U. S. Consolidated *Catalina*, which it resembles in many ways. Like the *Catalina*, the Dornier's wing sits on a thick "island" attached to the hull, and is externally braced. Instead of floats on the wings, however, the Do-18K has fixed sponsons on the hull. The wing has moderate leading and trailing edge taper, rounded tips and drooping flaps and ailerons the length of the wing. The two engines are mounted in tandem, one a tractor and the other a pusher. Single rudder and fin. The horizontal fin is externally braced.

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HOW TO PREVENT AIR

★ ★ ★ ★ ★ ★

by

Dr. G. R. WENDT

Dr. Wendt is the author of some 30 scientific papers in the fields of physiology and psychology. His interest in airsickness developed out of 10 years research on the functioning of the internal ear and led him to the preparation of this report.

NO ONE is absolutely immune to motion sickness. Foul weather may make the doughtiest veteran of the deep develop that pea-green feeling. And those who are "never, never sick at sea" can succumb to rough going in the air.

But in ordinary conditions airsickness, seasickness, car sickness or other motion ills can be prevented or cured if the causes are understood. This is good news to the men whose duty takes them in airplanes that drop in bumpy air, or loop, roll and dive in combat maneuvers, or who travel in towed gliders tossing behind a plane.

The great importance of avoiding motion sickness in combat troops, air crews and Naval personnel is now widely recognized. With the fall of France and its loss of a front close to the enemy, it became clear that assault will in many cases involve transport by planes, gliders or invasion barges.

In civilian flying in peacetime, motion sickness was thought of as a minor discomfort—a joke to anyone except the unhappy victim.

No officer, however, would want to take into action a company of airborne troops who were weak from repeated vomiting. Mild airsickness may be fatal when it attacks a pilot flying by instruments or the gunner of a military plane in combat. Even in the civilian flying in wartime, airsickness may be of serious importance if he has urgent official business to attend to at the end of his flight.

Chronic fatigue among air personnel, which means a disabling staleness and lost enthusiasm for the whole job of flying, is probably in some cases produced or aggravated by repeated mild or severe airsickness.

If bad cases of airsickness can be prevented during the training of air personnel, the men can usually be made so used to rough weather that they would ordinarily not be sick even on long flights. But if, through carelessness, they are permitted to get a bad case of airsickness before this "hardening" is complete, it takes much longer to build up their resistance.

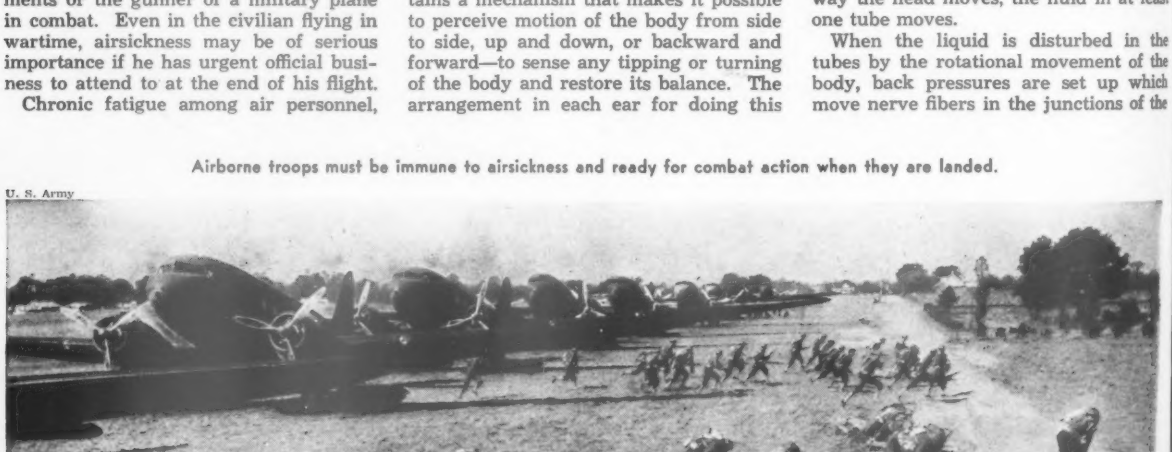
Many different things contribute to sickness besides the motion of the plane itself. Use of the eyes in instrument watching or in reading, noises, smells, constipation, abnormal temperature (high or low) and previous indiscretions of eating or drinking, are among the many factors that may contribute to motion sickness. A man has been made airsick while still standing on the ground in an airport, just by hearing the noise of the motor tuning up. It is possible to be airsick in perfectly calm weather; you can be seasick on a placid river.

We carry the chief cause of motion sickness around in our own ears. Besides the hearing apparatus, the inner ear contains a mechanism that makes it possible to perceive motion of the body from side to side, up and down, or backward and forward—to sense any tipping or turning of the body and restore its balance. The arrangement in each ear for doing this is a set of horseshoe-shaped tubes filled with fluid and attached to a membranous sac. There is one set of three tubes for each ear, placed in three different planes, one horizontal and two vertical at right angles to one another, so that, whichever way the head moves, the fluid in at least one tube moves.

When the liquid is disturbed in the tubes by the rotational movement of the body, back pressures are set up which move nerve fibers in the junctions of the

Airborne troops must be immune to airsickness and ready for combat action when they are landed.

U. S. Army



SICKNESS

Nausea will not bother student in this Fairchild PT-19 if instructor is smart.

The common ailment of nausea is a serious problem in our vast pilot training program. Here is how it may be solved.

tubes. These, in turn, set up impulses which are transmitted to the brain.

There are also other nerve fibers in the inner ear which are weighted with tiny bony particles. When you move up and down in air bumps or in any straight-line direction, these weighted fibers are bent and send their messages to the brain.

It is by these means that we are able to maintain equilibrium. Continued disturbance of these organs causes sickness because the nerve messages go not only to the part of the brain that tells you whether you are upright, but also to the part of the brain that controls vomiting. The susceptible man's weakness, it is interesting to note, is not in his ears, as might be supposed. It is the vomiting mechanisms of his brain that are abnormally sensitive.

It is not alone the violence in the disturbance of these organs, that is responsible for sickness. Head movements of everyday life set up much more violent disturbances in these ear nerves than do any of the movements encountered in airplane flights. You do not get seasick as you walk, run, dash upstairs or step off a curb, or when you play football or ride horseback. This is because these movements give a series of jolts to the head, none of which is of long duration. And a movement in one direction is usually followed quickly by a compensating movement in the opposite direction.

The motion of a rowboat on a small inland lake with choppy waves does not often produce seasickness. That comes on the big swells of the ocean where the motions are long and slow. People don't get sick on horseback; they do on a camel.

An automobile driven on curves in a mountain road, where coming into the turn and coming out are well separated, produces illness in a large proportion of passengers. Repeated rides on high-speed elevators in skyscrapers or swinging in a slow swing have the same effect. A dancer who whirls around and around would get dizzy if she didn't snap her head around with each turn in a sudden quick movement, and usually after spinning around in one direction for a while she compensates by "unwinding" in a counter-direction.

Very long movements cause sickness; violent motion without long phases does not cause it. Long and violent motion is worst.

In an airplane in ordinary straight flight, it is usually the up and down movements caused by bumpy air that produce air sickness. Occasionally these drops are as much as hundreds of feet and they have much the same effect as a similar drop in a fast elevator. The roll of a plane from side to side, and the yawing motion from left to right and right to left on the same level, would probably not, in themselves, make anyone sick but they contribute to the distress when combined with the vertical motions.

In pilot training, however, the worst motions are not those caused by bumpy weather, but those encountered in the various acrobatic maneuvers — spins, stalls, spirals, slow rolls and so on. The cadet should be introduced to such motions carefully. If he shows any sign of becoming sick—paleness, perspiration on the upper lip or forehead, gulping—the maneuvers should be discontinued immediately and, if necessary, the student brought down. A little caution at this point may prevent a complete washout on account of chronic airsickness later when a great deal of time and money have been invested in the man's training.

Altitude may bring on motion sickness. The combination of altitude and rough, bumpy flying or combat maneuvers will sometimes cause sickness in individuals who might withstand either of these factors alone.

An alcoholic hangover, constipation and bad colds are instrumental in inducing airsickness. Extreme fatigue, overeating or other physical upsets may contribute when they are present—anything which in itself would tend to produce nausea is aggravated in its effects when combined with the motion of an airplane or other vehicle.

The part played by most of the host of other sights, sounds, smells and feelings that bring motion sickness is due not so much to the naueating qualities of the troublesome sensations themselves, as it is to their previous association with an attack of motion sickness.

The most encouraging thing about curing or preventing motion sickness is the fact that individuals can learn to be motion sick or can learn to be resistant to it.

The learning is of the simple, direct

kind known to psychologists as conditioning—you may not even be aware of learning. But when you are violently nauseated, everything around you at that time and the things you were doing just previously become so linked with the nausea that they, too, get the power to make you ill.

If you are sick while you are drinking a cup of cocoa, the taste or odor of cocoa may nauseate you thereafter. If you have been sick repeatedly in an airplane, just the sight of the interior of a plane, the noise of the propellers, the smell of passengers' baggage, the view of the landscape below or any other seemingly irrelevant details may serve to make you queasy.

Most potent of all these acquired causes of motion sickness are, of course, the sight, sound and smell of sickness in others. Another powerful trigger for setting off nausea is the memory of sickness. For this reason, any sort of bodily discomfort—heat or cold, improper ventilation, an over-full stomach—that draws the traveler's attention to his own body and how it feels may remind him of previous motion sickness and help to bring on an attack.

The expectation that you will be sick acts in a similar way. It is for this reason that it helps if you keep your mind diverted from how you feel. A pretty hostess on an airliner, by talking to the male passengers, can do more good than would any medicine. On the other hand, a hardened traveler or a solicitous friend can talk a person into being sick. And you can talk yourself into it if you are apprehensive.

Every trip made without sickness increases tolerance for motion. Every trip on which sickness is experienced makes the person more susceptible.

Prevention and cure of motion sickness both depend on repetition of trips successfully made without nausea. To accomplish this:

1. Make short trips first.
2. Make initial trips only in fine weather.
3. Don't try acrobatic maneuvers with an inexperienced flyer.
4. Until tolerance is established, don't fly when upset by hangovers, fatigue, constipation, unwise eating or minor illness.

As the individual's experience increases, his tolerance increases, so that he can expose himself to longer and rougher flights without illness. Eventually he may become capable of making flights under all operational conditions.

The student can help himself to build up tolerance to flight motions by getting used to similar motions on swings and various amusement park devices. He should always be careful not to continue the rides to the point that he is made sick by them. He should do it for fun, not with a grim determination to grin and bear it.

Another result of flying without sickness is a lessening of the expectation of being sick. When you are not looking for sickness, not thinking about it, you are not so likely to become nauseated.

(*Continued on page* 142)

REPORT FROM WASHINGTON

By special arrangement, this monthly feature appears simultaneously in FLYING and "The Aeroplane" London

POSTWAR aviation is, in many respects, beyond the blueprint stage. It is being engineered and flight-tested right now. Military necessity has accelerated the progress of aeronautics, forcing us to telescope years of normal technical development into a mere matter of months. Every day great contributions to our knowledge and skills are being made by our scientists, designers, engineers, production men, tool makers and plain workers—both men and women—in our aircraft, engine, and precision instrument plants. The experience of pilots who are flying our ships and putting them to their one conclusive test—actual sustained performance in the air—is being built into the new models of those planes, with the result that they are being continuously and rapidly improved in design, structure and operating efficiency.

Charles I. Stanton*

Many of the things now in mock-up or on the machine in our factories come under the head of confidential military information. They are being saved as a little surprise—but what a hair-raiser—for Hitler and his brother "Aryans" in Italy and Japan. But enough can be said to indicate in a general way what lies ahead, once the war is won.

Today we are producing more than 5,000 planes a month, which was pronounced an "impossible" feat less than three years ago. And that figure will be doubled by the end of 1943. Our production is a monumental achievement and literally staggers the imagination.

In 1939, the total production of the aircraft industry was $280,000,000. It soared to $1,800,000,000 in 1941, making a huge jump to $6,400,000,000 in 1942. And now we are told by the War Production Board that during 1943, it will be three times again as large, rising to $20,100,000,000—a colossal sum representing a fourth of our war budget for the year, and about a seventh of our estimated national income!

Growth of production is matched by the phenomenal growth of our non-combat air operations. The Army Air Transport Command has already established a network of services encircling the globe, and it is being constantly extended as military needs arise. At the present time the Command is flying 15 types of ships along routes totalling more than 60,000 miles. The magnitude of its operations will be trebled by the end of the year, and if the war continues into 1944, the Command anticipates flying a maze of global routes 10 times the combined routes of all the pre-war airlines in the world.

In its domestic operations alone the Army Air Transport Command has more pilots, planes and stations than the entire Army Air Force of 1938. More than 1,000,000 pounds of urgently needed cargo are being flown each week to points throughout the Western Hemisphere. Its planes are setting down everything from jeeps to blood plasma in Africa, Alaska, Australia, India, China and points in between. "We can point to the prompt delivery of more than a hundred tons of needed material at one spot where other transportation would have been disastrously slow," writes Col. Harold Harris, Chief of its Plans Division. "All of our development is a window upon the future. The pressures upon us have led to improvisation and new techniques which will have a profound effect upon future of air transportation."

Expanding operations have compelled us to intensify our exploration into many new fields of great promise. For one thing, quantity of production has made it necessary to streamline and rationalize our methods of manufacture. This will stimulate both commercial and private flying. The plane will never take its proper place in the pattern of American life until it is brought within the reach of the many and ceases to be the rather expensive plaything of the few. Long strides have already been made in that direction. Many manufacturers now promise us—and we can, I think, accept their assurances—that after the war we shall have small, safe, economical, private planes which will cost no more to buy and operate than a medium-priced car.

For another thing, quantity production has stimulated research in finding new structural materials to replace aluminum, magnesium and other scarce strategic metals in the manufacture of planes, parts and accessories. A large concern, specialists in building modern streamlined trains for the railroads, is now building a fleet of "flying boxcars" made of stainless steel. Other companies have turned to the use of plastics and plywood with great success, and the future of "cooked craft" and "flying furniture" is already assured. The speedy *Mosquito* bombers which recently visited Berlin and helped the Nazis celebrate the 10th anniversary of their bloody rise to power, are samples of flying furniture.

The use of plastics and plywood offers

(*Continued on page* 162)

* Administrator, Civil Aeronautics Administration.

Coming from the four major fronts of this war, these photographs show something of the airplanes, men who fly them and the men who maintain them for combats with Germans, Italians and Japs.

WAR IN THE AIR

RUSSIA

Russian factory workers pose before a Stormovik IL-2 attack bomber line-up.

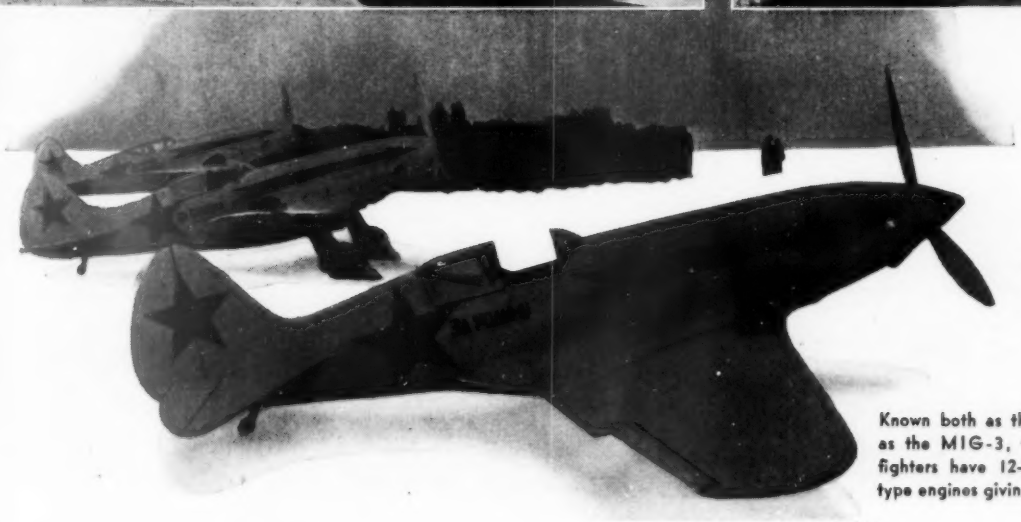
Sovfoto

Now at the Russian front, this Stormovik low level attack bomber carries rocket activated bombs. This armored single-seater is powered with a 1,300 h.p. inline engine.

Sovfoto

Mechanics are checking the engine of one of Russia's latest intercepters, the I-26.

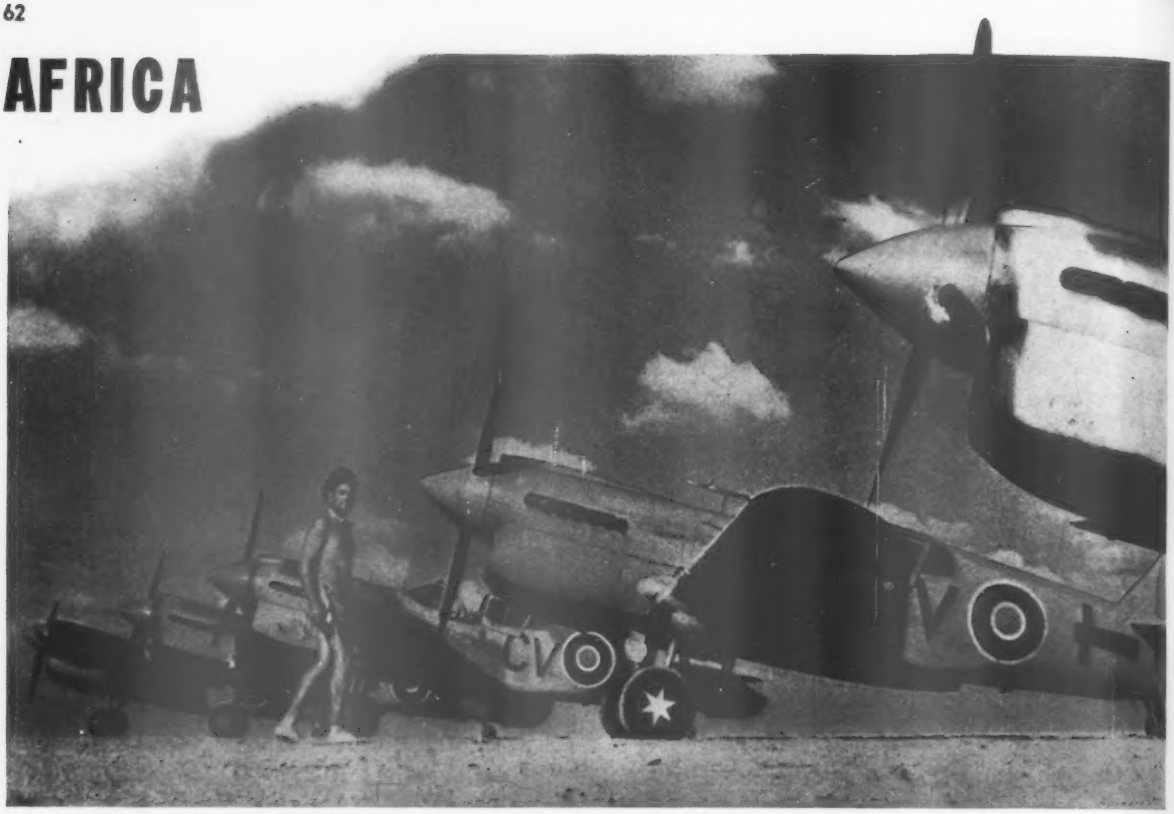
Sovfoto



Known both as the I-18 and as the MIG-3, these trim fighters have 12-cylinder V-type engines giving 1,200 h.p.

Sovfoto

AFRICA



Curtiss "Kittyhawks" in the Middle East desert, part of an Australian squadron equipped exclusively with these fighters.

An RAF Bristol "Beaufighter" turns its four 20 mm. cannon on an Axis supply train. An instant after this photograph was taken the locomotive exploded.

Acme

Graves of German pilots are marked by their own twisted, broken propellers.

Acme

Lockheed "Hudson" transports of the RAF flew ammunition, fuel, rations and water in maintaining Allied supply line.

International

International

Wrecked Junkers (Ju-87's) and Messerschmitts (Me-110's and Me-109F's) were found on this captured Nazi field.

Acme

Each tailing a plume of desert sand, Douglas "Boston" bombers take off for a bombing mission over Africa.

A late model "Stuka" (Ju-87D) was captured by the British during a desert attack. Nazi emblem was painted out before it was flown to the rear.

International

CHINA

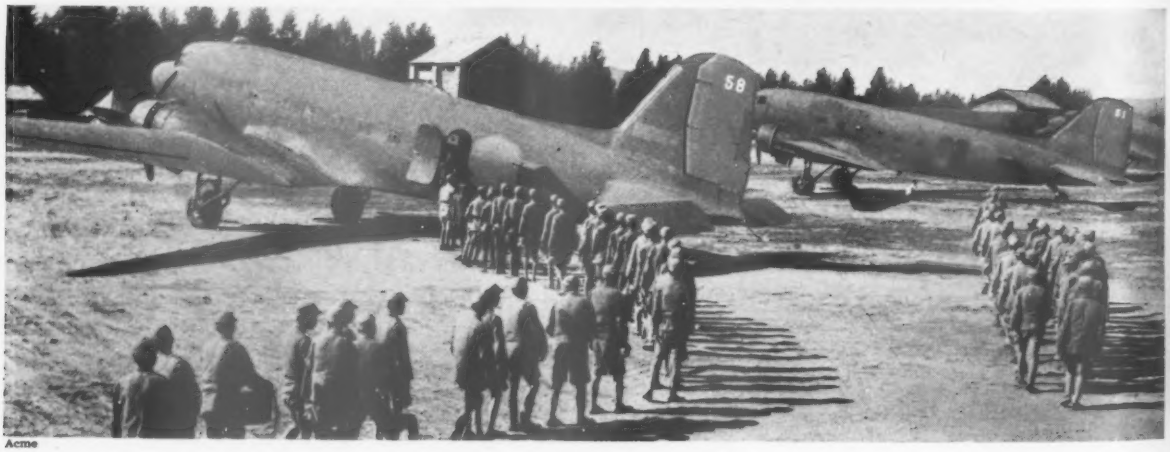
Guarded by a barefoot Chinese sentry, these U. S. Army Air Force Curtiss "Kittyhawks" have succeeded the "Tomahawks" of the Flying Tigers. "Kittyhawk" has six .50 caliber guns and larger engine.

Acme

Army Air Force pilots stationed in China hold the small identification flag issued them by the Chinese. It insures a safe return to their field if forced down in unoccupied China.

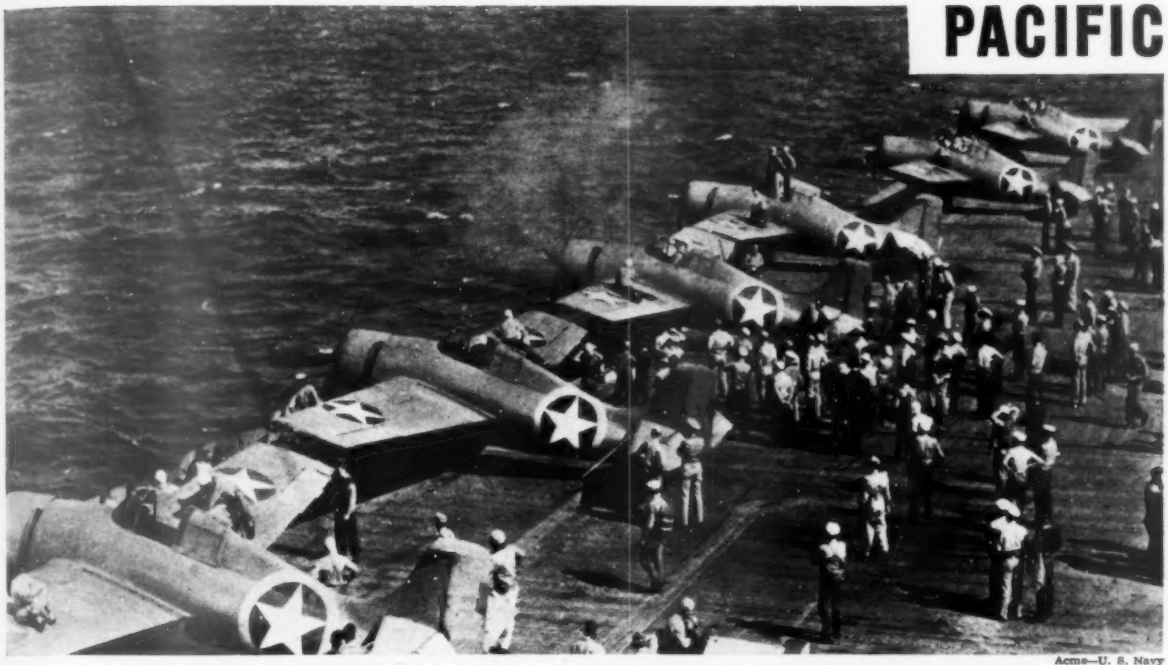
International

Chinese troops board Douglas "Skytroopers" (C-53) for transportation to the front. These planes are also used for Burma air convoy hauling.



Acme

PACIFIC

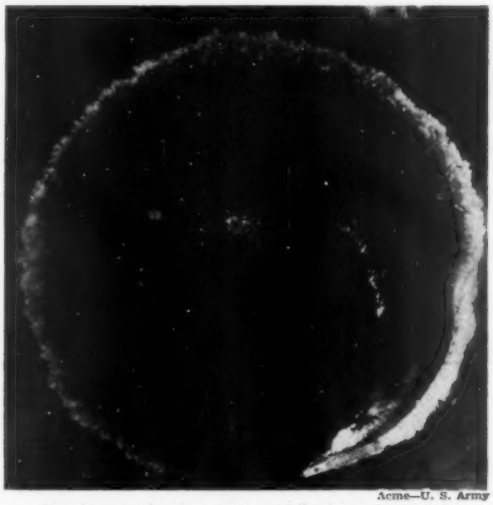


Acme—U. S. Navy

Grumman "Wildcats," the mainstays of the Navy's aircraft carrier force, line up along the decks of their ship testing machine guns. Each plane has six .50 caliber guns. "Wildcats" are built by both Grumman and General Motors.

Acme—Marine Corps

Two of the "Fortresses" in this picture are flyable. The other, along with "Dauntlesses," "Wildcats" and "Avengers," were damaged and junked.

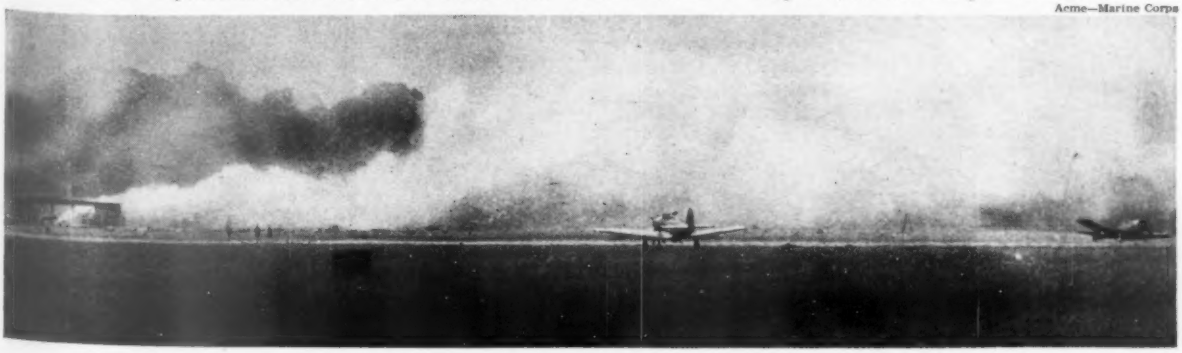


Acme—U. S. Army

The skipper of a Jap carrier wildly drives his ship in wide circles to avoid a "Flying Fortress's" bombs.

A Jap air raid on Henderson Field was in progress when this picture was taken. The hangar has received a direct hit. Aircraft are dispersed all around the field to reduce losses. Note "Airacobra" in foreground, and the damaged "Dauntless."

Acme—Marine Corps



HAVE YOU SEEN?

Press Association, Inc.

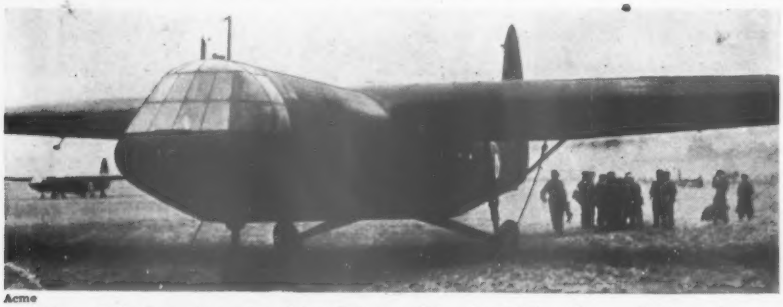
The Bristol XLQ-1, U. S. Navy's first amphibious glider. Made mostly of wood, craft carries 12 men, fully equipped.

International

Forced down in Newfoundland, the pilot of this RCAF "Hurricane" was found five days later by a "Catalina" (shadow).

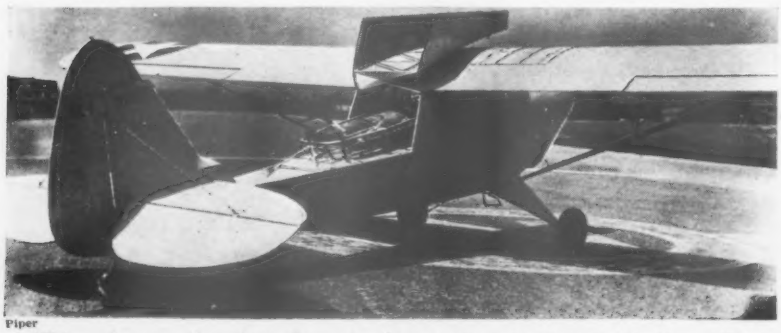
Lockheed

The Vega "Ventura" can take punishment and come back for more. Seven feet were torn off wing tip in strafing raid.



Acme

One of the huge transport gliders being used by the RAF's airborne divisions, this Airspeed "Horsa" has been reported in Africa. Note tricycle gear and large cockpit.

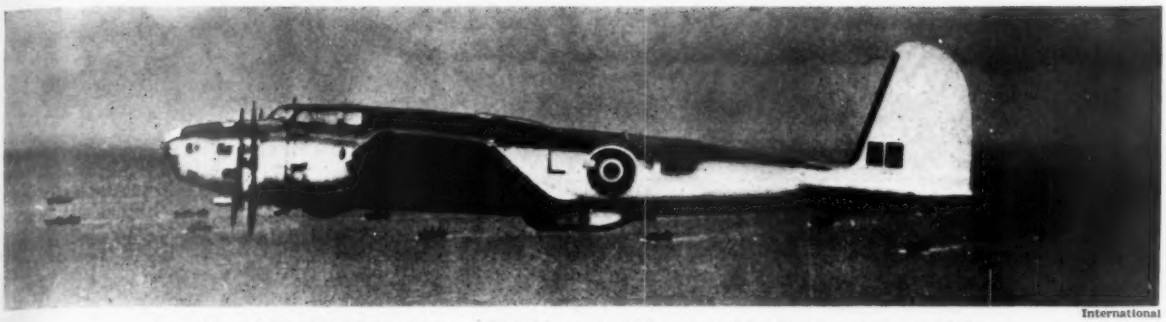


Piper

Pilots and crews of crashed planes are flown to base hospitals in this Navy HE-1, special ambulance design built by Piper Aircraft Corporation. Note hinged roof.

Acme

Civilian pilots in the Army's Air Transport Command now wear standard officer's uniforms, with disc insignia representing the Kitty Hawk memorial to the Wrights.

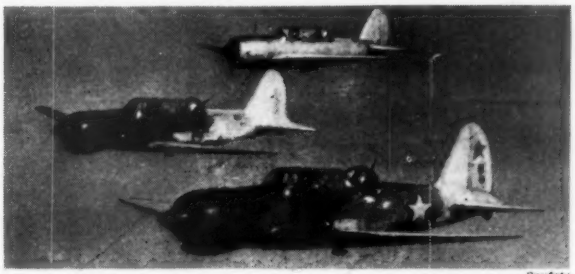


International

An early model Boeing "Flying Fortress" (B-17D) roams off the coast of England on convoy guard duty.

Glenn L. Martin

By removing bomb racks and gun mounts, plus making other changes, a Martin "Mariner" (PBM) becomes a cargo airplane.



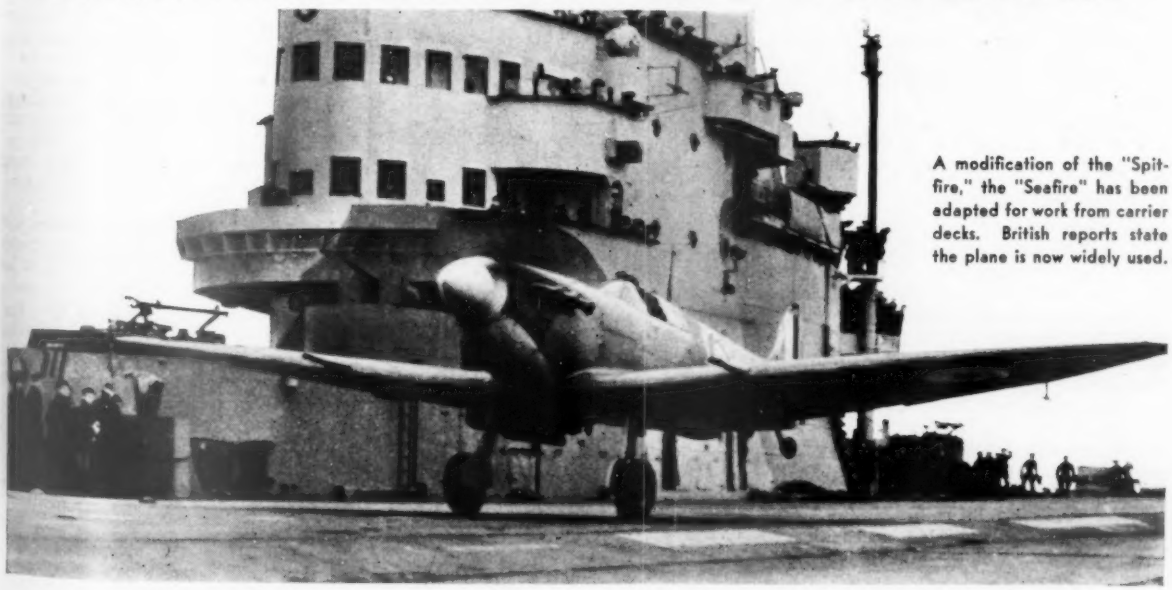
Sovfoto

Powered with a 1,000 h.p. motor, this Russian SU-2 has proven capable as a good light dive bomber and fighter.

Dick Whittington

Developed by Interstate, the L-6 liaison plane has been accepted by the U. S. Army for aerial messenger missions.

A scale model of the North American "Mitchell" bomber is tested in wind tunnel. Man holds either bomb or torpedo.



A modification of the "Spitfire," the "Seafire" has been adapted for work from carrier decks. British reports state the plane is now widely used.

I LEARNED ABOUT FLYING FROM THAT!—No. 44

by Maj. H. S. MAZET, USMCR

Major Mazet joined the Naval Reserve in 1928, transferred to the Marine Corps Reserve in 1929. He was on active duty during 1929 and 1930, and from 19?? to 1938. He served as an instructor in the Army's primary program, 1939-1940, returning to active duty December, 1940. The opinions and views he expresses are his own and are not to be construed as official, or reflecting those of the Navy Department.

Landing to investigate undue vibration, this pilot found his gunner's safety belt beating a tattoo against the tail group!

IT was a night of smooth air and already on the apron of the airport, somewhere on the east coast, several observation scout planes sat with idling exhausts as their pilots and gunners changed between flights. A gas truck was busy fueling. One flight had come to earth, and another was about to take off. I was to pilot one of the planes on the next run.

Marine Corps planes these were, old Curtiss *Helldivers*. Plane crews were busy checking and servicing. Lights flickered briefly. Now and again the door of the ready room shone bright in the darkness and a cigarette glowed here and there.

I walked out from the hangar, adjusting my helmet and carrying the chute over one shoulder. An engine revved up, and it was almost time for the take-off.

My gunner had already clambered aboard and was in his cockpit, settling down inside the machine gun scarff-ring. I stepped up on the wing and into the forward cockpit, adjusting my safety belt and checking the instruments.

The signal came for starting the take-off.

"All right?" I yelled back to my gunner.

"Okay, sir!" came the reply.

I opened the throttle for a check, revved down, signalled for the chocks to be removed, and taxied out for the take-off. The O2C-1 wheeled around, headed down the runway.

We gathered momentum. Gradually the ground sped past us, then fell away below under the pull of our 450 h.p. engine and we were climbing steadily. To my right the glow of city lights grew brighter, and to my left stretched the Atlantic Ocean, black as the inside of a pocket.

Suddenly I sensed that something was wrong. The plane trembled under my control, shook incessantly with a fore and aft motion that was alarming. Momentarily I considered that my passenger was moving the stick in agitation, but its steady pulsation indicated mechanical origin. A quick calculation convinced me that I could return to the field if necessary, and I breathed more freely. Focussing my attention on the engine I checked instruments and found all to be functioning normally. Yet the violence of the shaking seemed to increase. Had my ailerons, or my elevators, suffered some unknown damage? The stick shook in my hand, but voluntary control movements had little if any effect on the persistent quaking that was almost imperceptibly increasing in intensity.

I shouted back to my gunner, while the engine was throttled down, to look aft and see if he could discover any trouble with the tail surfaces. He looked, but he might as well have been staring down into a deep well at midnight. In that black vacancy it was impossible to see anything.

Major Mazet, whose gunner also learned a lesson the hard way. Plane is a "Falcon."

We continued to fly in a large arc alongside the field. In an analysis following my first moments of alarm, I soon began to realize that the difficulty was not growing much more pronounced; indeed, now it seemed to have stabilized into a steady, persistent shaking, and engine speed apparently had no effect on it. The ship was still flying well, we did not seem to be in any immediate danger, and the tremors (while bad enough) were evidently not going to make a forced landing at once imperative. But what could be causing the vibration?

Racking my brain, I could find no reason for the peculiar performance of that ship, which I had flown many times before. We were within easy reach of the landing area, as I was still carefully remaining within gliding distance while circling. I debated as to whether the trouble was grave enough to demand that we terminate the flight, for I disliked having to give up the flight once it was started. Yet something most definitely was at fault.

Believing that discretion in the air is worth more than a lot of argument after a parachute jump I finally decided to glide in for a landing. From my gunner came no word of either help or censure. He was leaving everything up to me. I eased the ship around for the approach, throttled back and came on in. The trouble was not so apparent during my glide.

Once on the ground the vibration ceased entirely. I began to feel a little foolish for having terminated the flight so soon because of a little shaking. The solid feel of the ground under me probably had something to do with the reaction, and I was sure that shortly I would be due for an unmerciful ribbing from my squadron mates for some insignificant trouble which would probably have ironed itself out anyway. Up above me, those other pilots were serenely carrying out their missions, and here I had grounded myself at the first opportunity!

I jumped to the ground on the apron, took off my chute, and moved toward the tail to hunt for the source of the mysterious vibration. When it finally came to light I was rather glad we had cut the flight short.

My gunner, in climbing aboard the ship, had settled himself securely in the seat without buckling his safety belt. In fact, *there was no safety belt in the cockpit.* His predecessor, a veteran flyer, had been wearing the belt as he left the cockpit, unsnapping it at the hooks whereby it is made fast to the fuselage brace members for machine gun firing. Then he had removed the belt and flung it across the turtleback where, in the darkness, it had been overlooked.

It was my gunner's first trip aloft! He had never missed the belt!

The belt had slid back when I revved

(*Continued on page* 167)

Winged Courier...

PIPER L-4

ALREADY a veteran on many fighting fronts, the Piper L-4 plane is serving our armed forces as a "Winged Courier." Hedge-hopping dense forests, crossing wide rivers, speeding over shifting sands . . . it carries personnel, important messages and vital supplies to Army outposts. Landing almost anywhere, it is off again in a flash.

Its remarkable maneuverability, dependability and economy, and its easy maintenance make the Piper L-4 a most versatile weapon. Besides acting as a "Winged Courier," it is serving Uncle Sam in the Artillery, Tank Corps, Cavalry and Infantry in many different ways.

And, when victory is won you will fly with ease to your favorite hunting, fishing and vacation spots and streamline your business trips in a smart peacetime version of this economical, easy-to-fly plane.

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PIPER POINTS THE WAY TO WINGS FOR ALL AMERICANS

ICELAND FLIGHT

Acme

A Lockheed "Hudson" leaves field in Iceland. Note "Airacobra" on ground.

by CLAYTON KNIGHT

Unsung heroes of the Air Transport Command, these former airline pilots are painted in colorful words by a noted aviation artist.

Clayton Knight

WE WERE somewhere between England and Iceland.

I was headed home after spending more than two months in the British Isles, visiting British, Canadian and American air stations.

My trip was almost over, but Capt. Stanley T. Stanton's crossing was just another one of a series that probably will last for the duration.

"Captain," I asked him, "what would you have said if you'd been told, back in the peaceful days when you used to kick these transports between Albuquerque and Kansas City, that someday you'd be flying them across the Atlantic?"

"Said?" he countered. "I wouldn't have said anything. I'd simply have quit flying."

But Captain Stanton, formerly of Parkville, Miss., and Kansas City, a graduate of the University of Michigan, didn't quit flying and now he's guiding former passenger transports across the face of the globe—to India, China, Egypt, England.

No, you never heard of him getting a Distinguished Flying Cross. In fact, you never heard of any of the little band of former transport pilots now with the AAF Air Transport Command getting any kind of decoration.

But the job they're doing is no less important than that of the bomber or fighter pilot. They risk their lives to fly transports across oceans—transports designed solely for transcontinental work.

They fly them—unarmed, mind you—right into the battle zones as they near the belligerent nations where they're taking their precious cargo of Government officials, vital war materials and diplomatic pouches containing secret documents.

Past the age for active Army combat flying, these pilots gave up highly-paid flying jobs with civilian airlines to serve their country in the air the best way they knew how.

Theirs is not a hero's job. It doesn't give them a chance to win honors. But it's vital, necessary work, and somebody has to do it in this world-straddling war.

And another thing about their job that, perhaps, calls for more sacrifice on their part than that of an active combat flyer:

The Army flyer assigned, say, to England, goes there and fights from there. His family usually knows just about where he is and is reconciled to having him gone for the duration.

But an ATC pilot never knows where he is going next. And to make it even harder, in between flights he comes home and snatches maybe a week's rest with his family—only to have to leave without revealing his next destination.

Such a part is Captain Stanton playing in this war, but others in the ATC—those actually in the Army and assigned to ferry duty—may find themselves stationed at lonely, isolated spots in the broiling African sun or in the wintry wastes of Iceland.

These chaps are not even as lucky as Stanton. They have no chance to see their family between trips—because they don't make any. They stay put.

I met a couple of these former airline pilots in a hut when Stanton set his plane down in Iceland, where I spent four days before returning to New York.

Their duties are to direct the flow of aerial traffic through that remote stepping-stone between North America and embattled England.

This calls for uncertain hours; waking up in the middle of an Arctic night to take care of a flight of fighters headed across the big pond by way of the island outpost; staying on the job all the next day seeing that planes are properly overhauled for the next jump; welcoming visiting dignitaries and sometimes entertaining them when at heart the Transport

(*Continued on page* 169)

SAFER LANDINGS for FIGHTING PILOTS

Firestone

CHANNEL TREAD AIRCRAFT TIRES

FAST fighting aircraft, landing on the decks of carriers, or on rough fields hastily improvised on desert or beach or jungle, to re-fuel and re-arm and carry the fight back to Nazi or Jap—imposed burdens on wheels and tires never heard of before.

At stake were the lives of pilots, the aircraft, the tires and the precious rubber they were made of. All must be conserved. These problems came to Firestone and Firestone came up with the answer. It is found in the revolutionary Channel Tread Tire. Its high shoulders and wide tread brace to take the punishment of these cruel landings, delivering up to ten times more than previous types. No wonder pilots swear by them — no wonder they have been standardized on most fast fighters.

Firestone is with these Fighting Pilots, and Fighting Planes, to Victory, and After!

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YOUNG MEN 16 and 17 EA

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You needn't let the war prevent you from finishing your education after high school. You can step right into the "University of Aviation" for a complete technical education that can lead you to one of the greatest lifetime careers of the future!

Here at SPARTAN School you can secure the kind of specialized training young men of America need today more than ever before. You can become a skilled aviation technician and reap the advantages accorded such men when and if you are called to military service. You will be in the industry that ranks at the top in America's march to victory. You will be preparing yourself for an important place in the great commercial aviation industry that is going to be of such tremendous importance after the war.

Hundreds of young men like yourself are now training at SPARTAN School to serve their country in a more valuable way . . . to be ready when peace comes to go ahead in a colorful lifetime career in aviation. SPARTAN is rated as the outstanding civil aviation training school in the U. S. Its 29 modern buildings, extensive shops and laboratories, great fleets of training planes, seven flying fields, skilled instructors and college-like system of educational training offer you advantages obtainable at no other school of its kind in the country.

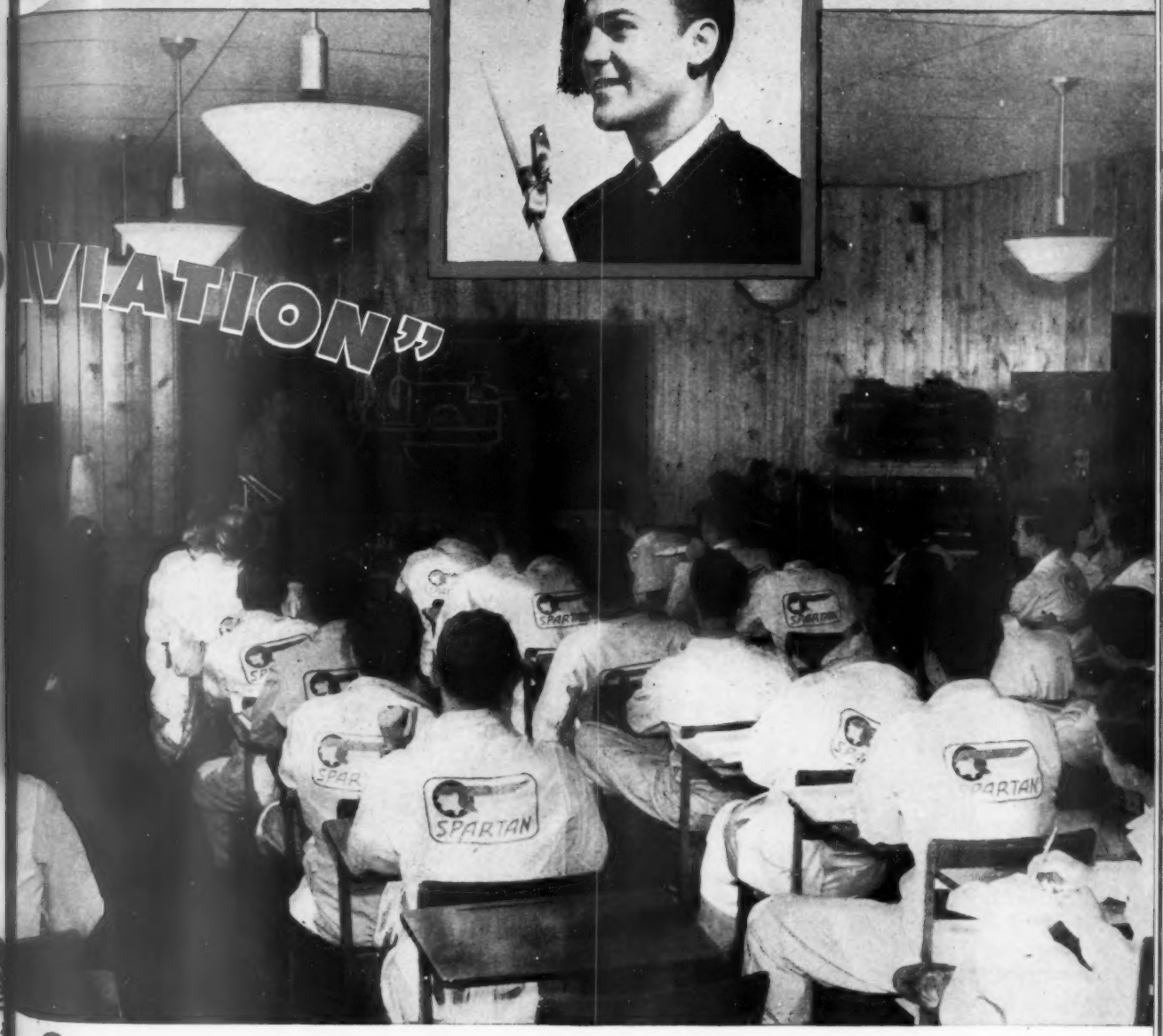
SPARTAN

A New Era in Aviation to Challenge the Imagination

Sky freighters are not just a dream of the future. Even now the U. S. is producing big planes which are doing yeoman service as war freight carriers. Gigantic planes which could be either oceanic bomber, cargo ship or transports carrying 400 passengers at a speed of 400 miles an hour have already been planned to the point where industry could begin producing. Aviation engineers are predicting that tomorrow speeds of 400 to 500 miles an hour will be usual . . . that giant passenger and freight planes will span the Atlantic in a few hours. All the world will be within easy reach of the men who are a part of the great aviation industry of the post-war "Age of Flight." And the young men who prepare themselves with proper aviation training now, whether for a place in the air or on the ground, will be the ones ready to take advantage of the tremendous opportunities for a prosperous lifetime career immediately after the war.

EARS OF AGE

AVIATION"



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- ☐ Aircraft Assembly Mechanic
- ☐ Airline Service (A&E) Mechanic
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Making Scrap in Africa!

POTENT instrument of destruction is the R. A. F.'s Martin "Baltimore" medium bomber, as the Nazi Afrika Korps discovered to its consternation.

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These Martin wartime developments will play a vital role in giving America the greatest commercial airfleets ever envisaged. Already giant over-ocean airliners of 125 tons lie ready-to-build on Martin drawing boards . . . while others of 250 tons and up, embodying even more spectacular developments, are in the planning stage.

Martin is ready, as soon as peace gives the green light, to help bring wings to the world!

THE GLENN L. MARTIN COMPANY, BALTIMORE, MD., U. S. A.

Beyond the War's End

From stern sacrifice on the battle fronts and the home front, a great post-Victory world is being built . . . a world of new discoveries, new abundance. For instance, Martin has designs for giant airliners of 125 tons . . . is planning others of 250 tons and more. These are ships that will bring the whole world within hours of your doorstep . . . ships that will build for a truly permanent peace by making all nations neighbors. In war or in peace, keep your eye on the Martin Star!

Martin
AIRCRAFT

Builders of Dependable Aircraft Since 1909

Member: AIRCRAFT WAR PRODUCTION COUNCIL, EAST COAST, INC.

Cornwall

BUILDS FOR VICTORY

STEEL TUG BOATS AND BARGES ★ WOOD TUG BOATS AND BARGES ★ COMPLETE WOOD DECK HOUSES READY FOR MOUNTING ★ AIRPLANE PARTS (WOOD) ★ MARINE LOCKERS, BUNKS, DESKS, BENCHES ★ MARINE CHART TABLES ★ MESS AND COOK TABLES ★ MILITARY TRUCK TRAILERS ★ BUS BODIES

★ ★ ★ ★ ★

Here is a completely integrated plant embracing the facilities of fourteen mills and assembly shops, occupying approximately a mile of waterfront on the Hudson River and served by two railroads. CORNWALL INDUSTRIES is producing 100% for the war effort!

CORNWALL INDUSTRIES, INC.
SHIPBUILDING CO., INC.

CORNWALL LANDING, NEW YORK

PLANTS FOUNDED 1840

Interstate L-6

LIAISON PLANE

AN ENTIRELY NEW DESIGN WITH EVERY ADVANCED FEATURE

NOW IN PRODUCTION FOR UNITED STATES ARMY AIR FORCE

INTERSTATE AIRCRAFT AND ENGINEERING CORPORATION

EL SEGUNDO, CALIFORNIA

Good Airmen Are Born,

THEN MADE

By Sound Instruction

The superior flying skill now being drilled into American military pilots is far more than the ability to fly. It is a frame of mind. It is a state of physical harmony with the demands of the job—down to the split second of muscular response.

Anderson Air Activities are co-operating closely with the U. S. Army Air Corps to meet the urgent demand for fighter and bomber pilots, with no relaxation in the quality of the instruction these men receive.

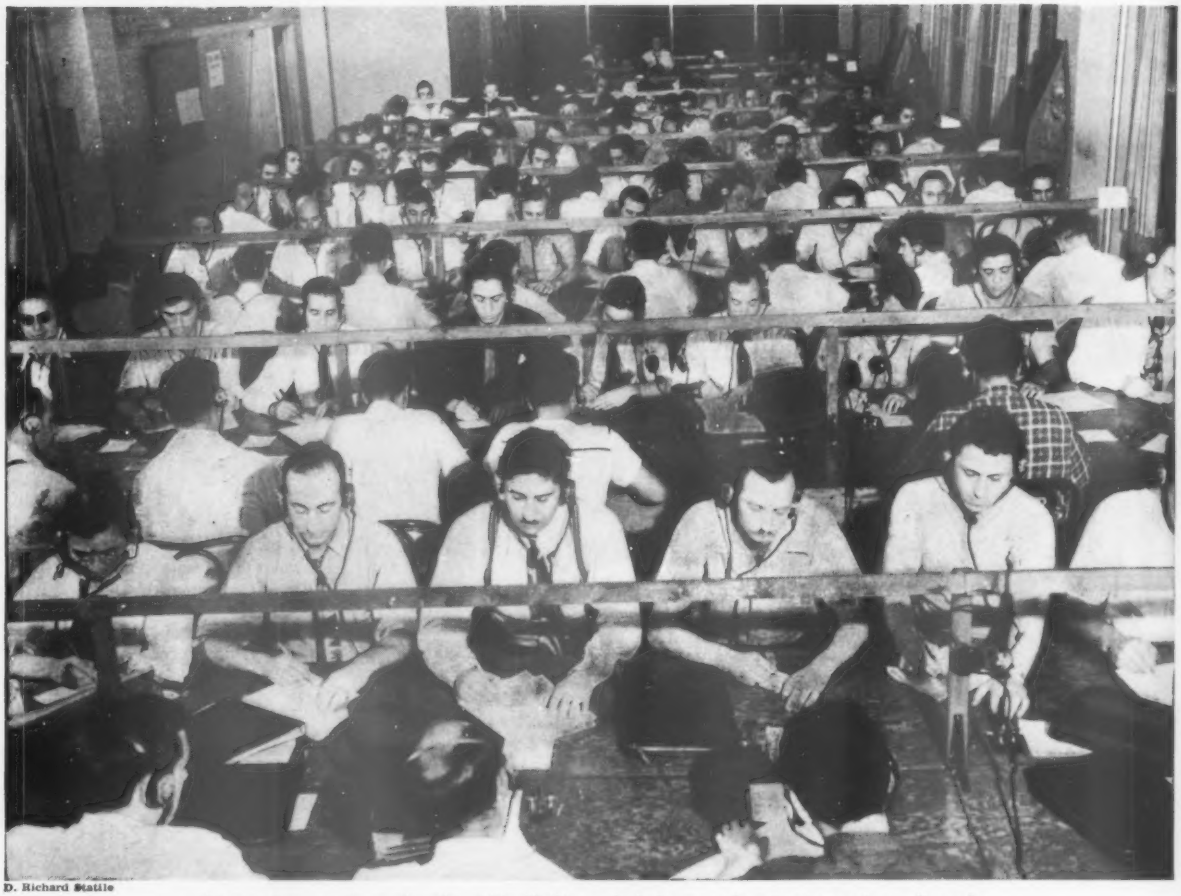
Anderson instructors, now developing cadet pilots to win the air over the Berlin-Rome-Tokio Axis, are qualified to teach not only flight but *what an airman should be.*

Edward Anderson

ANDERSON *Air Activities*

Address Correspondence to ANDERSON AIR ACTIVITIES, Chester Field, McBride, Mo. Home Base: General Mitchell Field—Cudahy, Wisc. Branches at Fond du Lac and Antigo, Wisc.

CONTRACTORS TO THE U. S. ARMY AIR FORCES



D. Richard Statile

Men and women from all walks of life fill this packed classroom learning to receive radio code.

COMMUNICATIONS SCHOOL

by LEWIS WINNER

When the Army and Navy began using up the available reserve of radio operators, Frank Melville started training replacements.

THE rapid expansion of airline activities and the unprecedented flow of specialists into the armed forces has created an acute shortage of trained communications personnel. Today hundreds of phone and high-speed code operators and radio mechanics are needed as quickly as possible, to man land and air communications equipment.

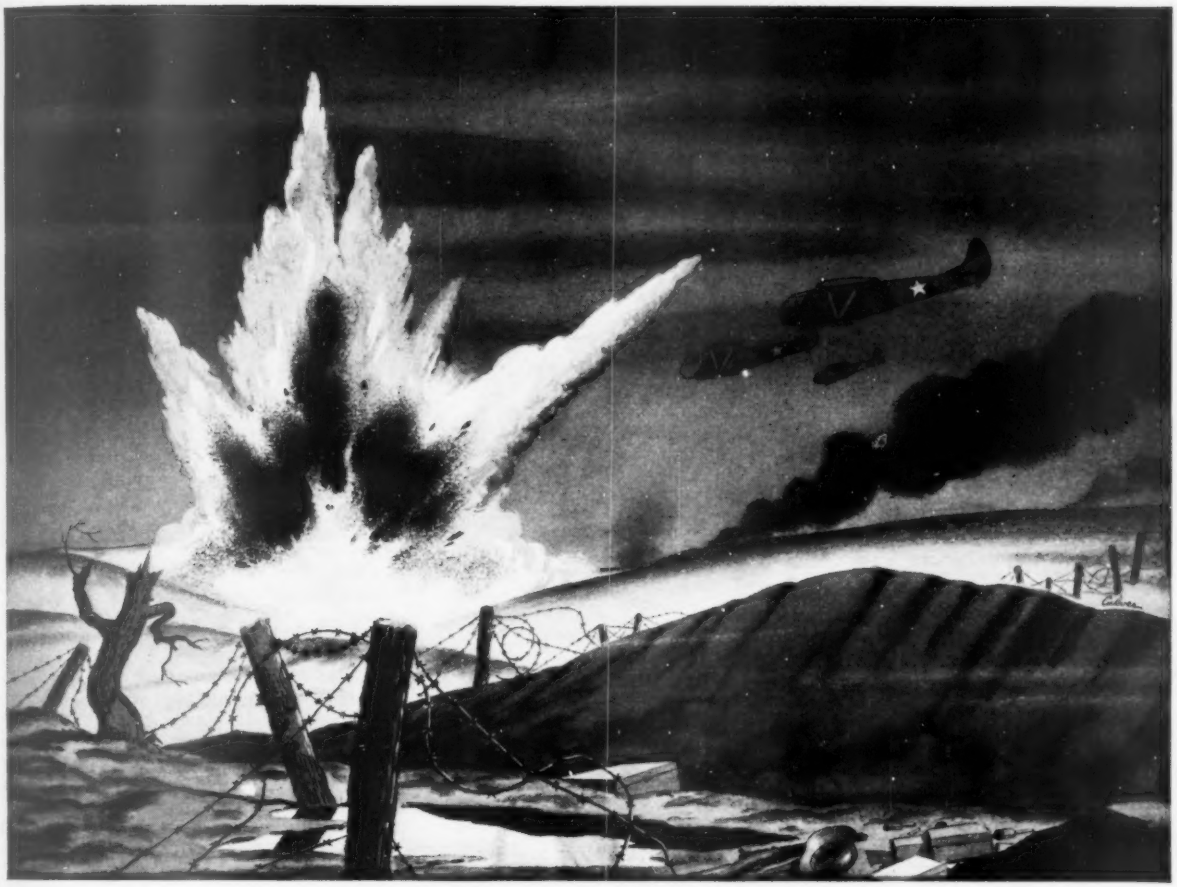
For the first time, airlines have had to supplement their training and recruiting programs with those of an independent school. The period of training has been reduced from years to a matter of months. And airlines have had to recruit many with nothing more than an "interest in radio," quite unlike the seasoned marine operators or radio amateurs, formerly sought.

This forced change of policy has not, fortunately, been one of regret. On the contrary, it has met with great success. With the aid of Frank Melville, an ace transoceanic flight radio operator, a school where hundreds of the much-needed expert radio men (and women) can be trained, was placed in operation. Graduates of the school already are active in the services of American Airlines, Pan American Airways, etc.

The school originated in the living room of the Melville home in Long Island, N. Y., with but two students—two students who now are with American Airlines as radio operators. Today the school is quite an institution, occupying four floors in a large office building in New York City, with close to 1,000 students enrolled.

Studying in the specially constructed sound-proofed classrooms of this new

(*Continued on page* 80)



NO MAN'S LAND IS A MYTH

There never was a war like this one. Time-honored theories, tactics and traditions have been exploded. Even no man's land has disappeared. Twenty-five years ago it was a desolate hell-hole of mud and wire. Today it is just a myth because the gliders have moved in.

Gliders are no respecters of persons or places. Soundlessly, they duck into (and out of) fields and clearings too small for planes . . . landing heavily armed advance forces and supplies virtually under the enemy's guns.

In our rapidly growing air force, nine- and fifteen-place gliders are being groomed for an assault on all fronts. They were designed by WACO . . . are now being produced in quantity by fifteen other plane manufacturers under WACO's supervision. Thus WACO—the oldest name in commercial aviation—becomes, until victory, a prominent name in military aviation.

WACO AIRPLANES

THE WACO AIRCRAFT COMPANY • TROY, OHIO, U.S.A.

D. Richard Statile

Students learn radio construction through the honored tear-it-down and assemble it methods.

Melville School

As voice is the most used form of sending and receiving aircraft messages, a class in voice culture is a necessary study for the operator-apprentice.

school are musicians, salesmen, electricians, photographers, attorneys, furriers and garment cutters, in addition to the men and women who have had actual radio experience or background. They study during the day or night, five times a week, for from four to eight months, depending on the course of study selected.

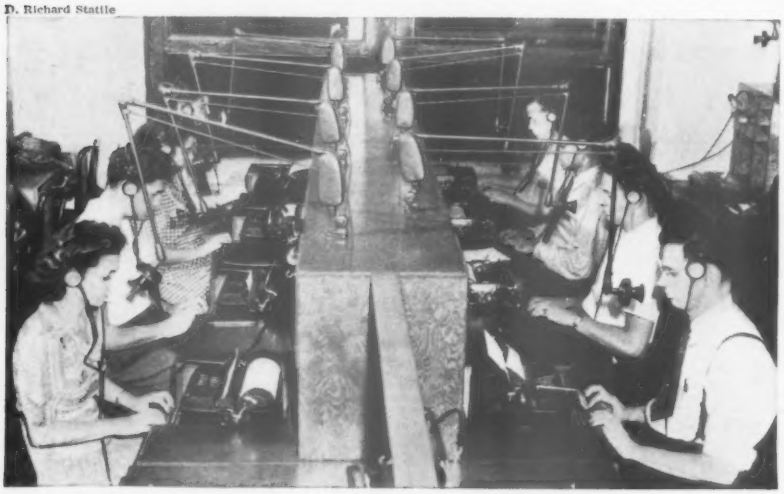
The courses are thorough and cover a multitude of topics, peculiar to flying practice. It isn't, for instance, only necessary to learn how to transmit signals by code at ordinary speeds, as we find in ordinary practice. High speed is essential. And in addition a complete knowledge of traffic procedure is vital.

The need for high speed transmission is prompted by the speed at which airplanes are being flown on round-the-globe schedules today. To transmit messages effectively, they must be sped to their destination so that any corresponding replies may be radioed to contact the speeding plane before the plane lands, or is out of reach. The operator of this equipment must be extremely alert, for unlike the marine operator, his ship is racing along, with no spot to stop for a study of conditions. His decisions must be instantaneous and accurate. This is particularly so during weather emergencies.

Among the many forms of airline radio messages that operators must be completely familiar with, are reservations, meteorological operations, flight reports, dispatches and flight plans. The reservation message requires a knowledge of all inter-company forms and blanks. The weather forecast message demands a knowledge of meteorological symbols, as well as a knowledge of data on the ceiling, sky, visibility, barometric pressure (in millibars), temperature (in degrees fahrenheit), dew point (in degrees fahrenheit), wind, altimeter setting, etc. A variety of special symbols are used to indicate wind conditions, sky and ceiling characteristics. Thus a message can be recorded with extreme rapidity.

In the school's phone room, men and women student-operators practice transmission of oral messages. Both oral and code messages could be received by this class.

D. Richard Statile



There are various types of service which the airline operator must know. There is, for instance, aviation service, which is a radio communication or special service carried on by aircraft stations, airport control stations, aeronautical stations, aeronautical fixed stations, instrument landing stations and flying school stations. There is also the public aviation service. In this service, the radio communication facilities are open to public correspondence to provide public communications to and from aircraft in flight. The aircraft station is a radio station on board any aircraft other than a public aircraft station. An aeronautical station is used primarily for radio communications with aircraft stations, but may also carry on a limited fixed service with other aeronautical stations in connection with the handling of communications relating to the safety of life and property in the air. An aeronautical fixed station is used in the fixed service for the handling of point-to-point communications relating solely to actual aviation needs. The airport control station furnishes communications limited to actual aviation needs between an airport control tower and aircraft stations in the immediate vicinity of the airport. A flying school station is used for communications pertaining to instructions to pilots while in flight. The instrument landing station is a special service station for facilitating the landing of aircraft. This may include a glide path transmitter, localizer transmitter, combination glide path and localizer transmitter and approach mark transmitter. The radio marker station marks a definite location on the ground as an aid to air navigation. This may be one of several types, such as

(*Continued on page* 156)

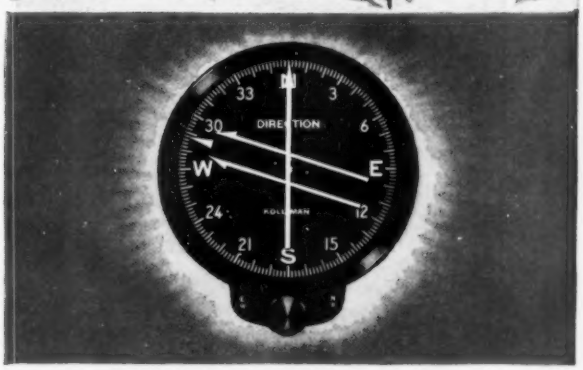
"She takes me there and she *Brings me Back!*"

"MAYBE ORPHAN ANNIE'S not as pretty as she used to be. Jap AA has lifted her face a few times, and her skin's lost that school-girl complexion. But she takes me where I'm heading for, and then she *brings me home.* And the dials on her instrument panel are the sweetest sight a man can see when he's five hours out and getting homesick."

"AFTER THE WAR, my wife will probably have *her* say when we shop for a family plane. She can have her choice of color, but I'll choose the instruments—*precision* instruments that can take it when the going gets tough, and still tell the *truth.* When I fly, I want to know where I'm going. With me, it's not *how fast* . . . it's *how sure!*"

KOLLSMAN
AIRCRAFT INSTRUMENTS
Product of
SQUARE D COMPANY

ELMHURST, NEW YORK • GLENDALE, CALIFORNIA



TYPICAL of today's fine precision instruments is the Kollsman Direction Indicator. Its easy-to-read dial corresponds to the compass rose appearing on all navigation charts. The reference index pointer can be set to any desired heading by turning the knob at the bottom of the dial . . . and a steady course can easily be held by keeping the pointers matched.

This advertisement is one of a series which will appear this year as Consolidated's contribution toward a clearer public understanding of "aviation geography."

CONSOLIDATED

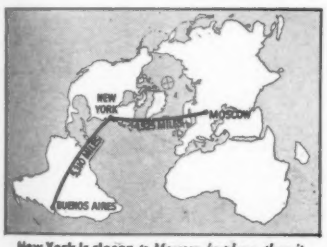
TO AMERICA'S FIRST PLANE SPOTTER

We don't know who you were.

But the night you went on duty marked the end of the world, as most Americans had always known it.

You were a symbol of the realization that oceans are merely hours across by air. You were an admission that the barriers of land and water had been lifted. You were our first bow to the new global geography where distance is reckoned by the skyways as well as by nautical miles.

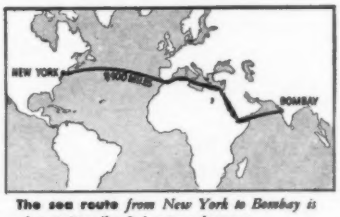
We are fighting the war today on that new global geography. We're fighting for remote pin-point islands in the Pacific because they can be potent air bases. We're fighting in the Aleutian fogs because from Kiska a bomber could strike at Detroit almost as easily as at San Diego.



New York is closer *to Moscow, by plane, than it is to our South American neighbor, Buenos Aires.*

There is no need to labor the point that this is an air-minded war. The newspaper headlines never let you forget it. And as you read them, remember that we must remain equally air-minded in victory.

The countries of this new, sky-linked world will be bound together more closely, geographically and physically, than our own states



The sea route *from New York to Bombay is about 9400 miles. It is a 3-week voyage.*

Today's skyword route *from New York to Bombay is about 7790 miles. Flying time: 39 hours.*

were at the turn of the century. Today, wherever you may live, no spot on the once-wide globe is farther than 60 hours away from your local airport.

Realization of how the plane has shrunk our world is vital to straight thinking about the kind of peace that *can* last. With this new conception of global geography, you see the world as it is—a clustering of nations whose nearness makes them inter-dependent and interrelated. Without this new conception, you are looking at a world that used to be—a world where nations lived in the safety of remoteness, protected by distances that no longer exist and seas that have been narrowed to millponds.

FROM	TO	SURFACE TIME		AIR TIME	
New York	Chungking, China	11,300 M	31 days	7500 M	38 hrs.
New York	Moscow, Russia	5700 M	8 days	4525 M	23 hrs.
New York	London, England	3700 M	5 days	3462 M	17 hrs.
San Francisco	Brisbane, Australia	8200 M	21 days	7050 M	35 hrs.
Chicago	Fairbanks, Alaska	4050 M	8 days	2730 M	14 hrs.

Approximate traveling time *and distances as you have known them in the past and as you will come to know them in the Air Age.*

But understanding alone isn't enough. If the global community is to live together in freedom and enduring peace after the war, the nations which deeply believe in freedom and peace must possess air supremacy.

To bring this supremacy about, first in war and then in peace, is the aim of the tens of thousands of men and women who make up America's aircraft industry.

• • •

Consolidated Aircraft Corporation

San Diego, California • Fort Worth, Texas

Member, Aircraft War Production Council

★ ★ ★ ★ ★

QUICK FACTS FOR AIR-MINDED READERS

In 1929, Consolidated was already building America's biggest planes. The company is 20 years old this year.

• • •

Today Consolidated is building: the B-24 Liberator, (4-engine, long-range, land-based bomber)—PB2Y Coronado patrol bomber, (4-engine long-range flying boat)—PBY Catalina patrol bomber, (twin-motored, long-range flying boat)—the C-87 Liberator Transport, (cargo-plane version of the Liberator bomber).

• • •

Winston Churchill used a Liberator for his flight to Moscow. General H. H. Arnold flew in a Liberator from Brisbane, Australia, to San Francisco in the record time of 35 hours and 53 minutes.

A Liberator, dubbed the "Gulliver," carried Wendell Willkie on his round-the-world flight. The 31,000-mile route blazed by this Liberator will probably become one of the regular skyways of post-war aerial travel and commerce.

• • •

Consolidated was one of the first aircraft manufacturers to establish a training school for Army Air Forces mechanics and ground crew. "Camp Consair"—complete with barracks, officers' quarters, mess halls, laboratories, classroom buildings, and hospitals — adjoins the Consolidated plant at San Diego.

• • •

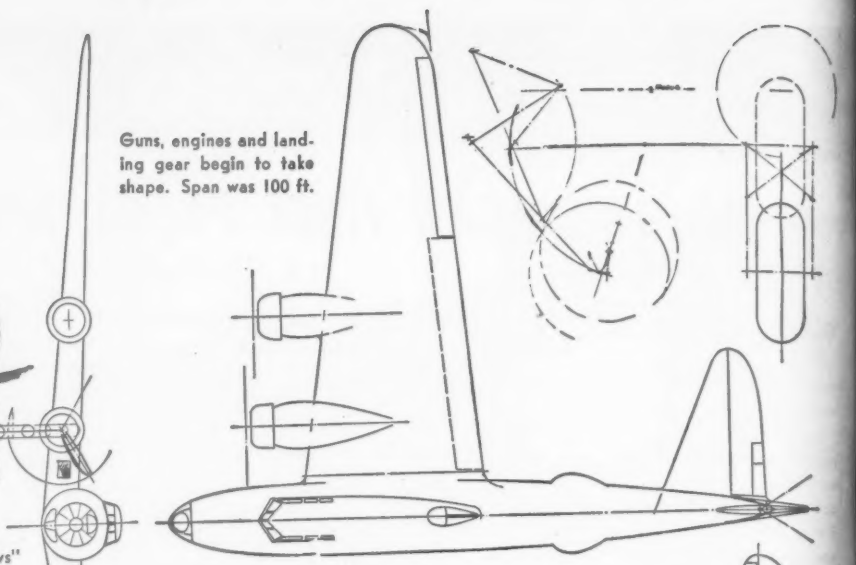
More than 2000 sub-contractors and suppliers, in many parts of the U. S., are working round the clock to provide many of the materials and parts for this giant Liberator.

AIRCRAFT ***DESIGNERS AND BUILDERS OF THE LIBERATOR, CORONADO, CATALINA, C-87 TRANSPORT***

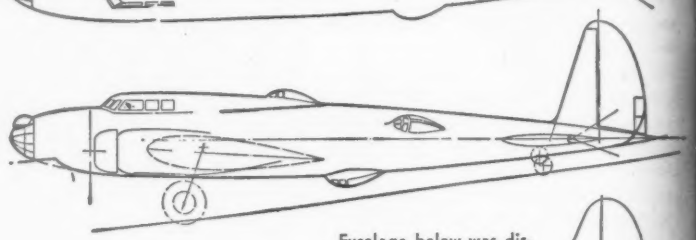
THE GREAT YANKEE Doodle

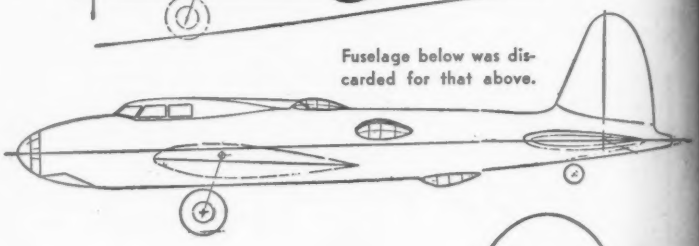
(5X5—MR.?)

Material courtesy "Boeing News"



Guns, engines and landing gear begin to take shape. Span was 100 ft.



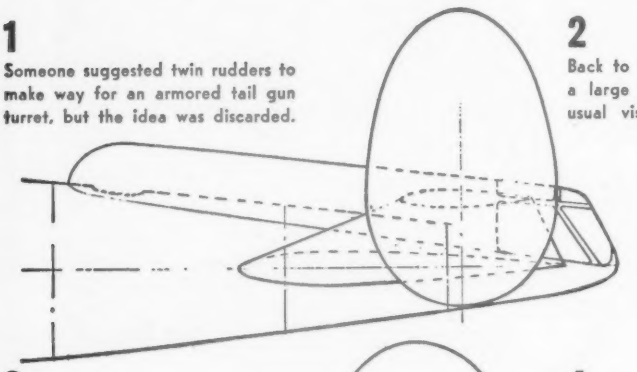


Fuselage below was discarded for that above.

ON August 8, 1934, what later proved to be a world-shaking document arrived in the mail at the Boeing Airplane Company, Seattle. It was a copy of a book outlining in great detail a four-engined landplane bomber. Known officially as U. S. Army Specification No. 98-201, the book went to Boeing's engineers. Shut up in a corner of the factory, the engineers read, argued and doodled. The drawings to the right show how the original *Flying Fortress* was doodled into existence. Ultimately those doodles turned into the first model of the airplane that has done much to revolutionize offensive aerial warfare. One serious fault—lack of a tail gun turret—was doodled out in the sketches directly below.

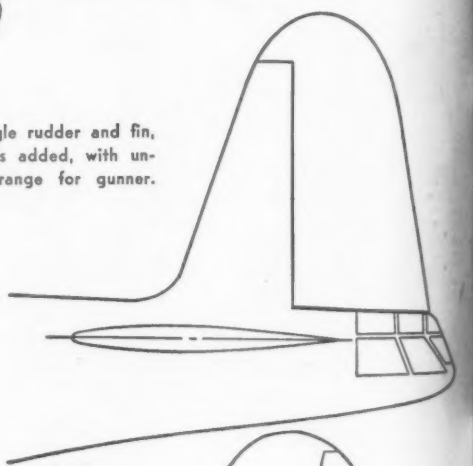
1

Someone suggested twin rudders to make way for an armored tail gun turret, but the idea was discarded.



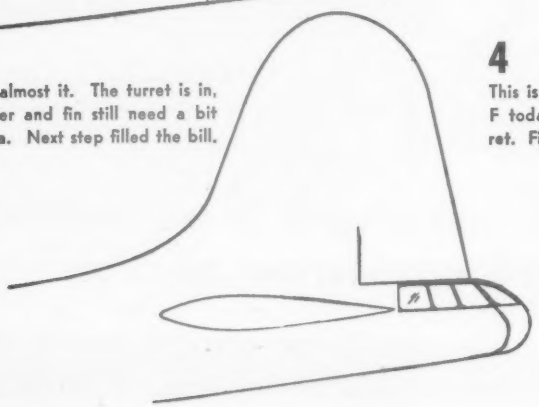
2

Back to the single rudder and fin, a large turret is added, with unusual visibility range for gunner.



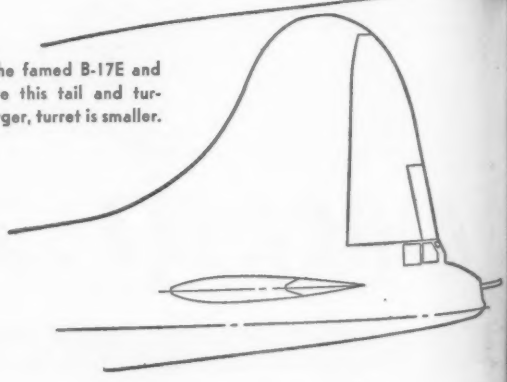
3

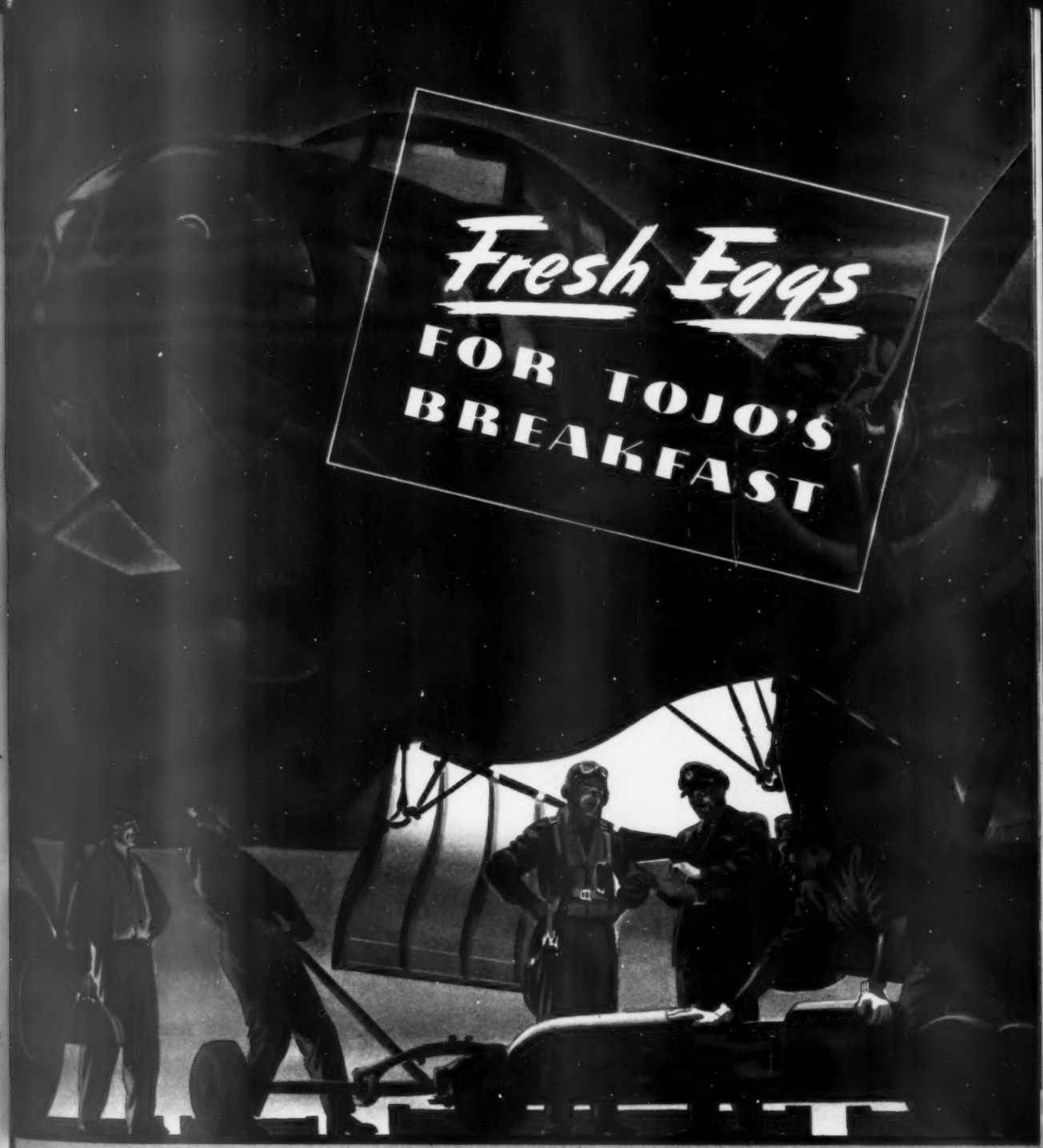
This was almost it. The turret is in, but rudder and fin still need a bit more area. Next step filled the bill.



4

This is it. The famed B-17E and F today have this tail and turret. Fin is larger, turret is smaller.





You've caused us a lot of inconvenience, Premier General Hideki Tojo. We can't get all the gas we'd like. Rubber is mighty scarce. There's a lot of rationing going on. Taxes are getting a little burdensome. Our boys are away from home. *And we don't like it . . .*

But you did one good thing—you made us build the greatest Air Force in the history of the world. And just to show our appreciation in a large way, we're going to suspend rationing of eggs and send you some nice fresh ones for breakfast—you little so-and-so.

AIRCHOX COMPANY, Division of JOYCE *Aviation, INC.*

General Offices, 8 So. Michigan Ave., Chicago

MAKERS OF THE WORLD'S FINEST PARACHUTE AND BELT HARDWARE

PERFORMANCE CONTROLS THE AI

Pesco Pressure-Loaded Hydraulic Gear Pump

Dogfight! Mastery of the air hangs in balance. Swarms of planes and pilots, spinning, diving, climbing, spitting streams of destruction. It's *performance* now or never . . . the craftsmanship of thousands of us here at home is put to the acid test. With lives and battles at stake, we dare not fall short of our responsibility.

In Aircraft Hydraulics, Fuel Pumps, Air Pumps, Related Accessories...

PERFORMANCE POINTS TO Pesco FIRST

DIVISION BORG-WARNER, CLEVELAND, OHIO

Automatic Pilot Seat

by S. R. WINTERS

An inventor has combined mechanical and medical data in producing a seat planned to reduce pilots' "blackout."

Latest dive-bomber in use is the Curtiss A-25 "Helldiver," Army version of SB2C-1.

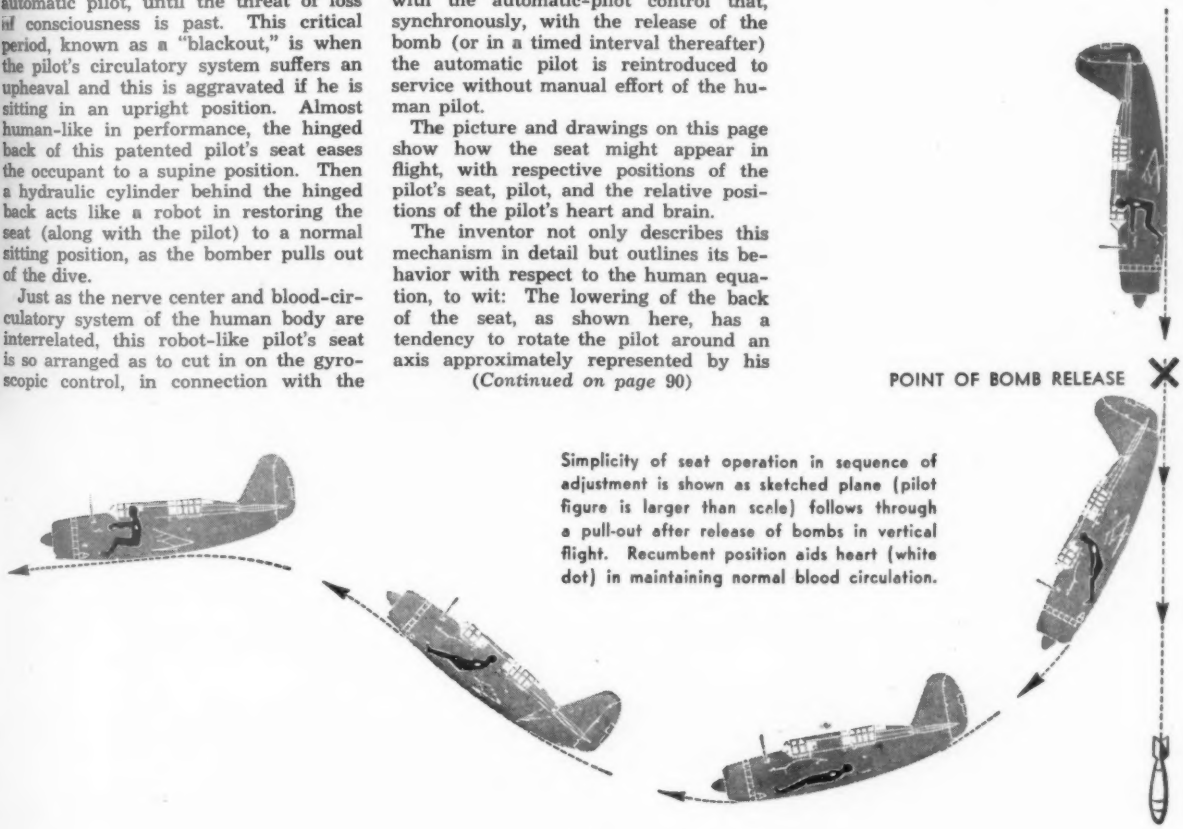
DESIGNED by Frederick P. Dillon of Los Angeles, Calif., a flexible, robot seat assists the pilot in assuming a supine attitude as his dive bomber swoops from a sudden downward position to an abrupt upward plunge. At the same time, the pilot is automatically relieved of control of the plane the instant he releases the bomb, shifting responsibility to the gyroscopic control, or automatic pilot, until the threat of loss of consciousness is past. This critical period, known as a "blackout," is when the pilot's circulatory system suffers an upheaval and this is aggravated if he is sitting in an upright position. Almost human-like in performance, the hinged back of this patented pilot's seat eases the occupant to a supine position. Then a hydraulic cylinder behind the hinged back acts like a robot in restoring the seat (along with the pilot) to a normal sitting position, as the bomber pulls out of the dive.

Just as the nerve center and blood-circulatory system of the human body are interrelated, this robot-like pilot's seat is so arranged as to cut in on the gyroscopic control, in connection with the bomb-release and the operation of the pilot's seat. The reclining chair thus is actuated automatically in synchronism with the bomb-release mechanism to lower the pilot in a supine position, and automatically raises the chair (thus restoring the pilot to his normal upright attitude) as the bombing machine levels off after pulling out of a dive. Secondly, the bomb-release mechanism is coupled with the automatic-pilot control that, synchronously, with the release of the bomb (or in a timed interval thereafter) the automatic pilot is reintroduced to service without manual effort of the human pilot.

The picture and drawings on this page show how the seat might appear in flight, with respective positions of the pilot's seat, pilot, and the relative positions of the pilot's heart and brain.

The inventor not only describes this mechanism in detail but outlines its behavior with respect to the human equation, to wit: The lowering of the back of the seat, as shown here, has a tendency to rotate the pilot around an axis approximately represented by his

(*Continued on page* 90)



Simplicity of seat operation in sequence of adjustment is shown as sketched plane (pilot figure is larger than scale) follows through a pull-out after release of bombs in vertical flight. Recumbent position aids heart (white dot) in maintaining normal blood circulation.

"E" for Excellence

☆ In receiving this joint citation of the Army and Navy, the management and personnel of The Weatherhead Company recognize that the award carries with it not only an honor but a grave responsibility. We will discharge that responsibility by making every effort to increase the flow of vital parts for 'planes, tanks, trucks, ships, combat cars, radios and munitions which Weatherhead plants have been turning out at the rate of millions every day!

Look Ahead with

Weatherhead

THE WEATHERHEAD COMPANY, CLEVELAND, OHIO

Manufacturers of vital parts for the automotive, aviation, refrigeration and other key industries.

Branch Offices: Detroit, Los Angeles, New York and St. Louis

HERE WE GO AGAIN!

"Abel Grasshopper . . . calling Battery B . . . direct hit on target—square Six!" . . . "Battery B to Abel Grasshopper—thanks, nice spotting!"

In World War One, hard-bitten boys in the Field Artillery were, strictly speaking, very much on their own . . . but the glorious job they did is a matter of current history. ☆ ☆ ☆ In today's mechanized warfare of swift move and countermove, the rolling caissons play an ever-increasing part of vital importance . . . and that's where we came in . . . for the new Aeronca Grasshoppers, tested in that grueling school of Army maneuvers, are now used by flying personnel as an ideal small ship for teaching the successful technique of fire control and target spotting, so necessary to effective Field Artillery operation. ☆ ☆ ☆ Officially designated as the Army's L-3-B, these "First and Finest" Grasshoppers give evidence to the job that Aeronca is doing, of making planes to the exacting requirements of our armed forces. ☆ ☆ ☆ This accomplishment in itself is significant proof of Aeronca's position of leadership in the lightplane field, and indicates what may be expected from Aeronca in the post-war era . . . after the Peace is won, you'll fly a Grasshopper! ☆ ☆ ☆ ☆ ☆

☆ ☆ ☆

A full-color book to delight the young in heart . . . Walt Disney's "Mr. Grasshopper Wins His Wings". Send 10¢ in stamps to Dept. F, Aeronca Aircraft Corp., Middletown, Ohio.

AERONCA

FIRST *Grasshopper* FINEST

© 1943—Aeronca Aircraft Corporation

pelvis. This action tends to exert a counter centrifugal force at the beginning of the bomber's pull-out, which, it is believed, facilitates the natural pumping action of the heart in relaying the blood to the brain. Thus, as can be noticed in the drawings, the elevation of the back of the pilot's seat is, preferably, so governed with respect to the flight of the bomber (as directed by the automatic pilot) that the human pilot, in effect, keeps a supine attitude during the major part of the climb. This position insures him an ample opportunity to go through the curve of possibly injurious centrifugal force before being restored to a complete upright position, which is achieved virtually at the same time with the leveling-off of the airplane.

This patented reclining chair has a seat-frame and a back, joined by hinges. These may be upholstered, but in reality a parachute pack is intended to rest in the seat-frame. The seat-frame is mounted on a base, which is secured to the floor of the pilot's compartment. The method of mounting is as follows: On the base is affixed a track, the latter being "twins" at opposite sides of the base. The seat frame has plates attached to it, upon which are mounted rollers; thus the fore and aft position of the seat-frame is adjustable, the rollers resting upon the tracks. Each upper flange of these tracks is formed with notches, with the rear notch having an abrupt drop, backward, and a more gradual incline, forward. The other notch is of reversed construction. These notches extend a "standing invitation" to the rollers, which are mounted on the seat-frame, whereby the fore and aft position of the seat is maintained flexible. For example, when the seat slides forward the rollers ride up and out of these notches—and if the seat is pushed sufficiently forward the rollers will drop into the notches. To prevent the seat-frame from jumping the track, the inventor suggests the use of an inturned flange or rim bordering the lower edge of each plate. This projected rim then exerts a tendency to engage the underside of the track and thereby holding the seat-frame in place.

The back is secured in a normal upright position by "twin" latching gadgets, these acting in concert with curved tracks. The latching arrangement consists of a housing bolted to any panel or framework, and mounted inside or forming a part of the airplane fuselage. Mounted to slide within this miniature "house" is a plunger, formed with an annular flange and an upward projecting latch. A compression spring is built in the housing and abuts at one end against the lower end thereof—and at its upper end against the flange.

The latch is normally and flexibly kept in its upward extended position, thus engaging, on its vertical face, with a roller or pin, secured by a bracket to the seat-back. This roller goes through an opening, into the arched track, which is preferably U-shaped in cross-section. It is in duplicate, each track being mounted on opposite sides of the seat, upon the panel, or frame, by screws or bolts, anchored at its lower end on a cross-piece, permanently secured in or as an integral part of the panel. The arched tracks perform the role of support and guide for the seat-back, when elevated and lowered.

The inventor prefers use of a hydraulic jack operating the seat-back. The usual dive bomber hydraulic controls fit admirably into the scheme of this main hydraulic system, with modifications. He uses a hydraulic line coupled with a hose, affording pressure for lowering the seat-back; another, associated with a conduit, furnishes pressure for raising the seat-back. These two lines of pressure-supply are shunted by a third, including an emergency valve, located within easy reach of the pilot; this subject to manual operation in the event that the automatic hydraulic control goes haywire. In the pressure-supply line there is provided a restrictor valve, which is flexible in the control of the flow of the hydraulic fluid to and from the hydraulic jack—thus governing the speed by which the seat-back can be elevated and lowered.

Two supply lines contact a double-unit valve, one unit of which is the pilot's seat and automatic-pilot master valve, and the other of which is the bomb-release valve. These valves are caused to function at the same time by a yoke which is shifted by a tug on a cable, the latter being attached to the lower end of the bomb-release lever, trained over two idler pulleys.

The result of opening the valve unit is to send pressure through the two fluid lines to the automatic pilot "gyro." Simultaneously, the valve unit is opened to relay pressure through the line to the bomb-release mechanism.

A definite time-lag between functioning of the "gyro" in raising the elevator for leveling-off of the dive bomber and the response of the latter, results in the back of the pilot's seat beginning to be raised while the plane is still climbing out of the dive.

END

Men Behind the Bombers

(*Continued from page* 39)

used. Then it was found that the starboard aileron had to come off, which meant a complete checking of controls. A completely new bracket had to be made for the bomb suspension support. The leading edge of the starboard fin had to come off and a patch a foot square be put on. Plates for the patches required were made on the spot and were riveted into place as fast as they were turned out.

While the maintenance staff was engaged on this work, the ground crew carried out their normal inspection. Twenty-five men in all—N.C.O.'s and aircraftmen—worked on the bomber until she was ready for the air again, and every man had his own particular job. There was no overlapping, waiting until "the other guy" was finished. Work on the damaged bomber was so arranged that nobody was ever in anyone else's way.

This was an example of the organizing ability of Flight Sergeant Pennington, which has earned him a high reputation in the squadron. He is called "Chief" by Flight Lieut. C. Couzens, the squadron engineer officer, who became a boy apprentice at Cranwell in the same year as Pennington. Lieutenant Couzens is very proud of his men, and with reason.

"They don't look at their watches, and they forget that they are hungry when there is a quick job to be done," he said. "There's no stopping them, and they're as proud of the aircraft as are the crews who fly them."

International

This "Wellington" flew home with turret, propeller, instruments and gear damaged.

Another example of the speed at which these men work is the way in which they repaired a *Halifax* which had severely damaged its tail plane in landing from a test flight. The entire tail unit—fins, rudders and elevators—was taken off, and another put on; a remarkable piece of surgery even when carried out at leisure. But this particular job was completed in one night, much to the astonishment of the aircrew when they came down to the airfield after breakfast to see how the work was progressing.

In appreciation of the keenness of this maintenance flight, a notice board has been fixed in their hangar on which details of the squadron's activities are recorded. These details include targets attacked, results achieved and the numbers of aircraft sent out.

Aircraft may come back damaged. But the maintenance staff can be relied upon to see that they are soon ready to take part once again in the bomber offensive.

END

Flight Commanders to Dodos Know

RYAN BUILDS WELL!

CONFIDENCE for the student pilot, incentive for the instructor, comforting assurance for those at home—all result from the knowledge that Ryan builds airplanes well. In the services of the U. S. Army, U. S. Navy and United Nations, Ryan Primary Trainers are daily proving to be the world's finest. Vital as trainers are to achieving victory, building them well and in volume has been only part of important Ryan war assignments.

War Bonds Today Insure Your Better Tomorrow

WHEN PEACE COMES, American industry will be ready with many wondrous products to make this a better world. Then, whatever Ryan Aeronautical Company offers for your better air transportation, remember, "Ryan Builds Well."

RELY ON Ryan TO BUILD WELL

RYAN AERONAUTICAL COMPANY, San Diego, Calif. — **Member, Aircraft War Production Council, Inc.**

Ryan Products: Army PT-22s, Navy NR-1s, Army PT-25s, Major Sub-Assemblies and Exhaust Manifold Systems for America's Most Distinguished Aircraft

NORTH AMERICAN SETS THE PACE

(One of a series reporting North American planes in action on the battlefronts of the world)

A FLIGHT OF NORTH AMERICAN B-25 MITCHELL BOMBERS HAMMERS THE AXIS IN NORTH AFRICA

NORTH AMERICAN PLANES MAKE NEWS AROUND THE WORLD

Mitchell and Mustang Take Part in Six of "Big Ten" Stories

TWO GREAT NAMES in the news are the North American B-25 Mitchell bomber and P-51 Mustang fighter. In a recent press association list of 1942's ten biggest war stories, there were SIX in which these planes figured!

Here are the roles they played: (1) B-25's bomb Tokyo. (2) B-25's play a major part in smashing Rommel's Afrika Korps. (3) Mustangs harass enemy in sweeps over Europe. (4) B-25's aid great Russian winter offensive. (5) B-25's destroy Jap ships, airfields, munitions in New Guinea. (6) Mustangs provide strong aerial support over Dieppe.

North American planes are making even bigger news in 1943 because they are even better than last year. We never "freeze" design. Whenever battle experience or production skill suggests an improvement, we change *right* now. Today's B-25, for instance, is more than 22,000 drawing changes better than the B-25's that bombed Tokyo last year!

This policy of constant improvement demands extra work and extra ingenuity from every North American employee. But it's worth it. It will win the war sooner. It will save many American lives. It will give *you* plenty of good news about North American planes on every battlefront from now 'til victory.

NORTH AMERICAN AVIATION, INC.
Inglewood, California
Kansas City Dallas
Member, Aircraft War Production Council, Inc.

THE FIRST AMERICAN PLANE designed entirely on basis of combat experience — that's the North American P-51 Mustang. Heavily armed, maneuverable, one of the world's fastest. American and British flyers call it "the best fighter plane of 1943."

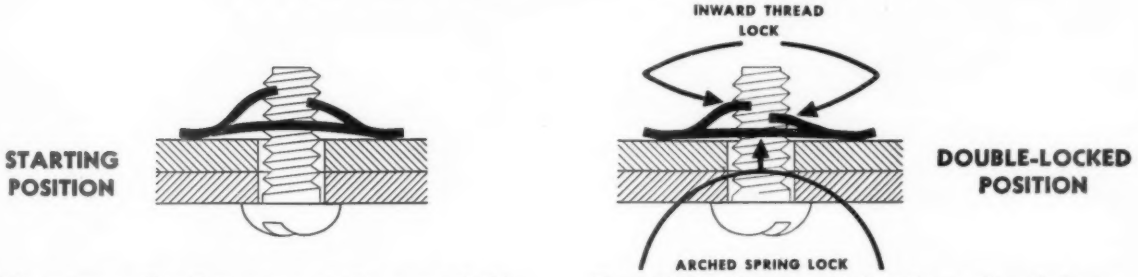
ARMY E NAVY

NORTH AMERICAN *Sets the Pace!*

DOUBLE SPRING TENSION LOCK

Speed Nut System
(PATENTED)

conquers vibration loosening



High-frequency vibration never made a nut hold firmer. Speed Nuts are made to grip the bolt or screw with a double spring-tension lock to absorb vibration and prevent loosening.

The harder the jam, strain or pull to separate two assembled parts, the firmer the Speed Nut prongs grip into the roots of the threads. That is what makes them about 4 times tougher than other lock nuts.

Over 1000 shapes and sizes have already been put into production. Every Speed Nut or Speed Clip has saved from 50% to over 80% in assembly time and weight. Already this has saved countless man-hours time and tons of material. Our Engineering Dept. will gladly assist you on the proper approved locations where Speed Nuts give maximum engineering advantages.

TINNERMAN PRODUCTS INC., ★ 2086 FULTON RD., CLEVELAND, O.

IN CANADA Wallace Barnes Co., Ltd., Hamilton, Ontario

Simmonds Aerocessories, Ltd., London IN ENGLAND

THE FASTEST THING IN FASTENINGS!

"FUEL" FOR FLEDGLING FLYERS

NO other soldiers in the world are better fed than the pilots of our Air Forces. As far as "kitchen mechanics" at Ryan flight training centers in California and Arizona are concerned, food is fuel for the fight and must be "100 Octane" (or is it calories?).

Of course there are no meals "as good as mother used to make," but mothers of men in training at Ryan can be satisfied that their offspring are eating mighty well. However, good food is only part of the routine in the world's finest pilot training program.

RYAN

RYAN SCHOOL OF AERONAUTICS

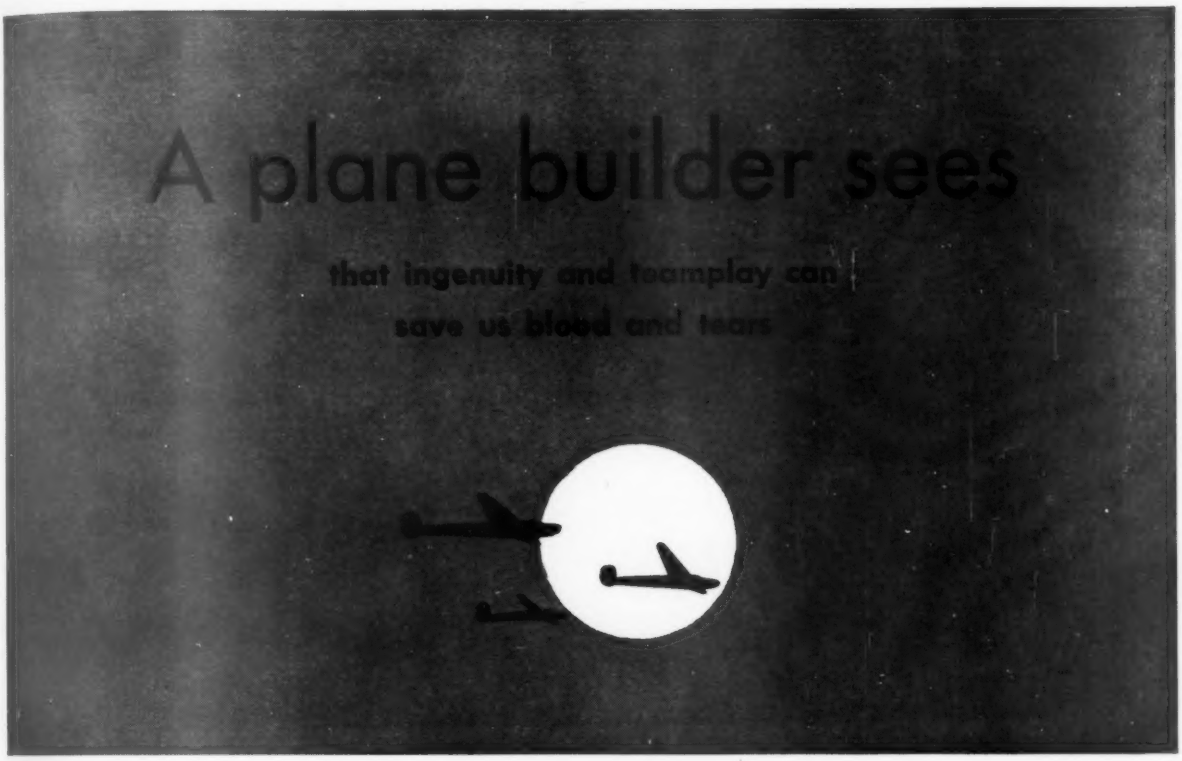
Headquarters, San Diego, California

RYAN SCHOOL OF AERONAUTICS, Hemet, California
RYAN SCHOOL OF AERONAUTICS of Arizona, Tucson, Ariz.

RYAN IS A GOOD PLACE TO TRAIN AND A GOOD PLACE TO WORK

Says Jean Bovet, Chief Steward of the Ryan School at Tucson, Arizona: "The proper feeding of Army cadets is recognized as one of the prime necessities for efficient pilot training."

DEDICATED FOR THE DURATION TO THE EXCLUSIVE TRAINING OF ARMY PILOTS



THERE IS A NEW electrolytic etching technique of duplicating templates for new-design warplanes. It saves 5 weeks in getting a new model from blueprints to fighting planes on the front. The "Northrop group" developed this technique, offers it to all U.S. plane builders.

There's a new "Heliarc" process by which magnesium and certain other alloy metals can at last be welded into aircraft parts. It uses *helium*, of which the U.S. has 98% of the world's supply. This Northrop development is being made available to other U.S. aircraft builders.

There's an improved way of cleaning and preparing sub-assemblies for spot welding. It helps to complete warplanes in less time, saves vital plant space. It also has been turned by Northrop into the "pool" every U.S. plane factory is free to use.

Into this same "all-for-one-one-for-all" pool other aircraft builders are turning new processes and discoveries.

Not only techniques, but production facilities are now shared by the industry. For instance, besides its own aircraft, Northrop has been making dive bombers designed by another company . . . engine nacelles for a bomber manufacturer . . . and tail-assemblies for a flying boat builder.

May we emphasize—there is nothing peculiar to Northrop in this kind of teamplay and ingenuity. *Today all of the aircraft builders in the United States are working as one. Because to do so will save American blood and tears.*

NORTHROP AIRCRAFT, Inc.

NORTHROP FIELD, HAWTHORNE, CALIFORNIA . . . MEMBER AIRCRAFT WAR PRODUCTION COUNCIL, INC.

CONQUISTADORES DEL CIELO

CONQUERORS OF THE SKY. These are the 20th Century warriors of Latin and South America... eager young men whose weapon is the airplane. Their's is a task worthy of a Simon Bolivar: train today, to teach tomorrow... so that the skies above *all the Americas* shall be forever free.

It is fitting that this nation should make vital training facilities available to our Good Neighbors, though now engaged in its greatest war.

It is appropriate, too, that many of the Inter-American students should be assigned to the Civilian Pilot Training Program at the Sky Harbor division of Southwest Airways. In our training of United States Army and Navy instructor personnel there... and Yank, English and Chinese military flyers at our other fields... we of the Thunderbird also are hastening the day when the skies above *all the world* shall be forever free.

SOUTHWEST AIRWAYS

Phoenix, Arizona

THUNDERBIRD FIELD • FALCON FIELD • SKY HARBOR • THUNDERBIRD II

TRAINING THE FINEST FIGHTERS TODAY, THE FINEST FLYERS TOMORROW

CONTRACTORS TO THE UNITED STATES GOVERNMENT • UNITED STATES ARMY • UNITED KINGDOM GOVERNMENT

"Everybody talks about the weather . . .

. . . but nobody does anything about it." No longer is this famous old quotation true. For Boeing engineers *have* done something about it!

They designed the Stratoliner*—the only transport airplane built to fly in the substratosphere, *above* the weather—where the air is thin, but smooth—where greater speed, safety, passenger comfort, and economical operation are possible.

In order to open up this new superhighway of the air, Boeing engineers designed the first cabin with automatically controlled atmosphere-conditioning. Thus at 20,000 feet, where the bitter-cold air is too rarefied for sustained breathing, the atmospheric "altitude" inside the Stratoliner is maintained at a level at which passengers and crew are comfortable. That's why the Stratoliner represents the greatest advance yet reached in the design and manufacture of commercial airplanes . . . and a guide-post to the future of flight.

Today, Boeing Stratoliners have discarded their gleaming mufti for drab camouflage, and employ their great speed and huge load capacity on errands of war . . . shuttling across seas and continents, hurrying men and materials out to the front lines.

And in another way, too, the Stratoliner is helping to win the Battle of the Skies . . . supplementing the work of another Boeing-designed and Boeing-built airplane—the Flying Fortress.* For the engineering and manufacturing lessons learned in building the Stratoliner and the Fortress are today being applied to creating still better military planes.

The engineering and production know-how acquired by Boeing in many fields—structural, electrical, metallurgical, aerodynamic and many others—this know-how will some day be converted . . . from making America victorious, to making the fruits of science and industry available to free men everywhere.

Engineering leadership . . . manufacturing efficiency . . . now and tomorrow, these are implicit in the phrase "Built by Boeing."

DESIGNERS OF THE FLYING FORTRESS • THE STRATOLINER • PAN AMERICAN CLIPPERS **BOEING**

*THE TERMS "FLYING FORTRESS" AND "STRATOLINER" ARE REGISTERED BOEING TRADE-MARKS

Ernest A. Bachrach

Combat Camera

by

WILLIAM STULL, A.S.C.

The Navy's new combat camera (in action, top photo) is light, built like a machine gun. Above, designer H. Cunningham.

FROM a B-25, a B-17, or name your own plane, a cameraman lifts a combat camera to his shoulder and begins shooting, exactly as he would wield a machine gun. He may film from low altitude the destruction wrought by an earlier sweep. Or he may, through a telephoto lens, reach out for a closeup of an enemy plane, battleship or carrier.

The combat camera, probably the first such instrument ever devised, comes from the shop of Harry Cunningham, one of Hollywood's most brilliant camera designers. It may be employed with equal facility from all planes where the cameraman has room for maneuvering, except, of course, it cannot be handled outside an open hatch at high speeds.

Design of the camera is really revolutionary. While it may be used from a tripod, it is intended primarily for hand operation. Instead of the usual box form, the device is designed in gunstock form, and the cameraman grasps it with two pistol grips while holding the butt against his shoulder. By these means, Cunningham has achieved perhaps the steadiest hand-operated camera yet developed. In fact, it has been found possible to hold steady on an object when using the 10-inch telephoto lens, a feat all movie cameramen will appreciate.

Officers and men employing the camera in the field will discover a facility of operation they never anticipated. For example the film magazine, carrying 200 ft. of 35 mm. film, may be loaded either in a darkroom or changing bag. The magazine then is dropped into the camera through a hinged opening at the top. A gentle push slips the magazine into place and automatically engages the drive and footage-counter connections.

There are no springs to wind, for the camera is electrically powered. Power is derived from two small radio-type "B" batteries carried in a small case clipped to the user's belt. These batteries, which may be changed in a jiffy, will run the camera for several thousand feet of film. They then may be tossed aside and new ones inserted. No matter which of three speeds the user selects — 16, 24 or 48 frames a second—the power system functions smoothly. A small button which slides in an arc-shaped slot on the left side of the camera governs the speed.

Of great interest to the aerial cameraman is the system of lenses. In the present model four lenses are built into the revolving turret—35 mm., 75 mm., six-inch and 10-inch. Lieut. Comm. John Ford, until recently one of Hollywood's ace directors, chose these lenses as having the most useful range for combat teamwork on the basis of his experience with the Fleet in the Pacific. In action, for example, four cameras might be supplied one photographic team, each man being assigned to use a particular lens. If the team is short-handed, a single operator can vary his shots from 35 mm. to the telephoto lenses simply by swinging the turret, done in a second or two.

There's no difficulty about focusing, either. On the right side near the pistol grip, within easy reach of the right hand, is a single focusing control. The lever may be operated by the thumb or ball of the hand, as the operator prefers. Two focusing scales are easily read. One covers each of the short-focus lenses. The long-focus lenses are calibrated at infinity, for general use, and 35 ft. for shooting identifying slates.

To focus, instead of rotating the individual lenses or racking the lens board in and out, the film magazines are moved out and in, within the camera. This arrangement makes for greater rigidity of construction because the lenses are mounted solidly, and only the turret as a whole is rotated to bring each into position in front of the film.

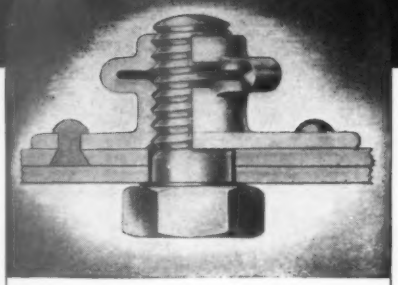
The finder is simple and interesting. On the 10-inch lens, for example, the field is indicated only by a central dot, because this lens will be used generally for distant view, and the dot enables the cameraman to follow a rapidly moving object easily by "aiming" through the dot. When using the 35 mm. lens, he views the field full-frame and an etched frame narrows the field when he employs the 75 mm. and three-inch lenses.

Cameramen who have used the camera from a plane say it is far easier to handle than anything they've had in the past. It weighs only 13 pounds (15 with the 10-inch lens in place), since it is built largely of magnesium.

The camera is a gift from Hollywood to the armed services. Cunningham began work on the device before the battle of Midway. Commander Ford and his Naval Photographic Unit photographed that epic victory by the Yankees. When his crew returned to California, RKO Studio opened their machine shops to the boys that work on the camera might be speeded. Cunningham built the first model at the Gower Street film plant.

The camera is planned for mass production, first in 35 mm., probably later for 16 mm., a size the Navy prefers because it is less bulky. The camera is well adapted to aerial work, and will have many uses in scientific photography. Meanwhile, because it balances perfectly and the pistol-like grips, combined with other structural features, give it unusual steadiness, the camera promises combat photography better results than have been achieved to date.

END



A Self-Locking Thread

The Boots Self-Locking Nut is one-piece, all-metal—withstands severest vibration. The top (locking) section is displaced in a downward direction so that its locking threads are out of lead with the load carrying threads of the lower section.

Upon the insertion of a bolt, the top section of the nut is extended to engage with the threads of the bolt. A constant force is thus established which locks the nut firmly into position without damaging bolt or nut. Axial thread play is eliminated.

50,000 LBS... PROTECTED BY A THREAD

It's mighty important that the threads on the nuts which hold together vital parts of the Commando troopship should be dependable . . . that they be proof against even the most severe airplane vibration.

Boots All-Metal Self-Locking Nuts are used on these largest of all twin-engined cargo planes. They are unaffected by vibration—literally "outlast the plane."

Boots Nuts weigh less than other self-locking nuts . . . thus they make it possible for the Commando to carry more cargo. And they have greater reusability in maintenance.

Boots Nuts meet the exacting specifications of all Government agencies, are used on all types of planes.

The new Boots "Rol-Top" Nut, all-metal, has special advantage for engine application.

BOOTS

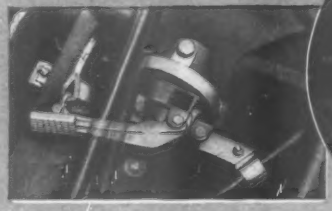
Self-Locking Nuts For Application In All Industries

BOOTS AIRCRAFT NUT CORPORATION ★ GENERAL OFFICES, NEW CANAAN, CONNECTICUT

IT'S SMOOTHER, SURER STOPS WITH THE NEW SCOTT "B-711" BRAKE PRESSURE UNIT

There's a real feeling of confidence when your heels engage the pedals of the newly-developed Scott Brake Pressure Units. You *know* you come to a smooth, safe stop when and where you want to. That's because these new hydraulic pressure cylinders are positive in action—absolutely fluid-tight—assuring top efficiency from the brake system. Designed for use on light aircraft using the expander tube brakes, these units may be adapted to other braking systems. Readily installed, and located with pedals in conventional relationship to the rudder pedal. Scott B-711 Brake Pressure Units are simple in design, durably constructed, light in weight (only 21 ounces). Each unit is exactingly tested to assure dependable, long-term performance. Economically priced. Write for illustrated folder.

The illustrations below show the locating and simple method of installing the pressure unit in the brake system: (1) Installation on Piper J-3 with floorboards removed showing method of reinforcing and attachment to structural members of fuselage. (2) Close up of left-side pressure unit showing cable extension to front seat brake pedal and attaching clamps. (3) Convenient arrangement of pressure unit pedal, located for easy, positive operation.



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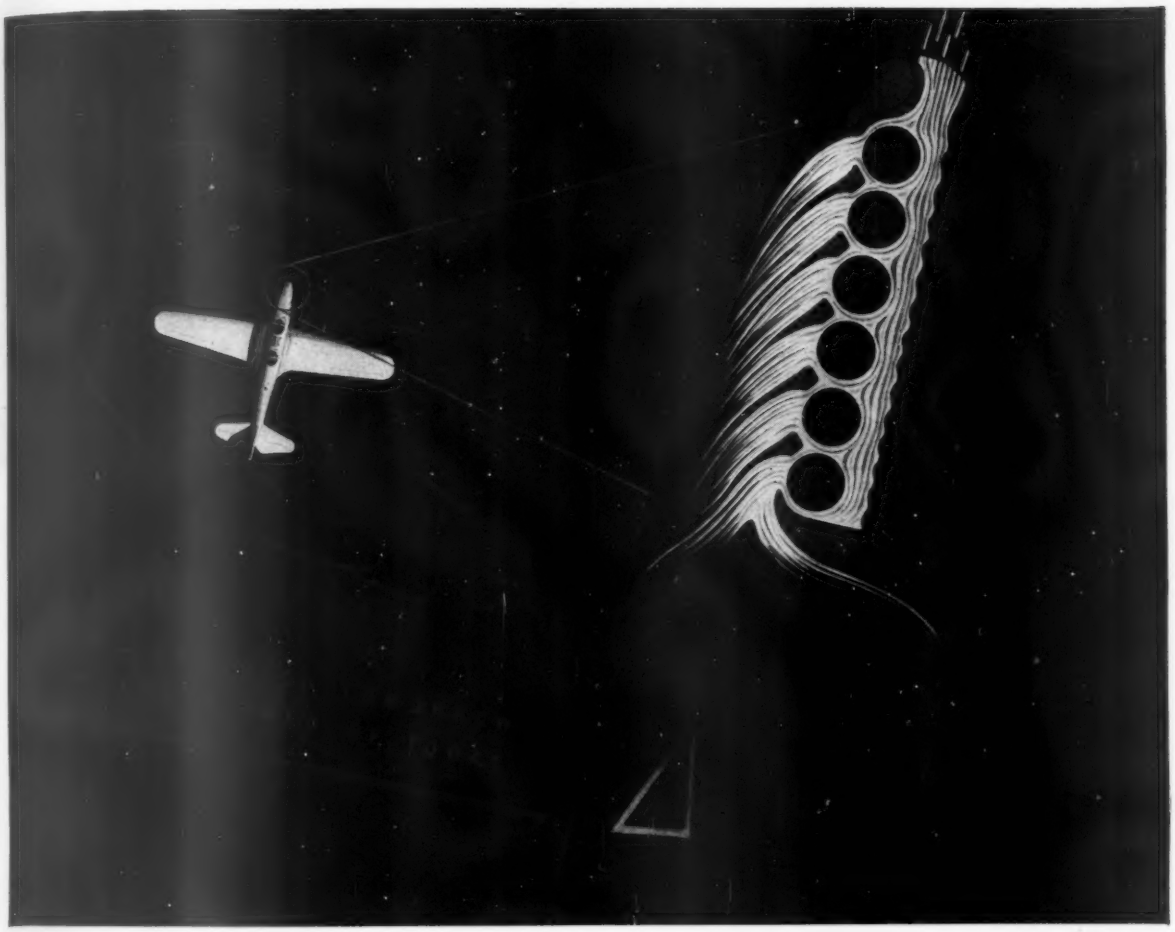
LANCASTER, N. Y., U. S. A.
DESIGNERS AND MANUFACTURERS OF SPECIAL EQUIPMENT FOR THE AIRCRAFT INDUSTRY

SUPPLIERS TO THE U. S. ARMY AND NAVY AIR FORCES AND LEADING AIRCRAFT MANUFACTURERS



Ranger Solves the In-Line Air Cooling Problem

A scientifically engineered air-scoop, baffle, and air pressure "reservoir" arrangement delivers uniform air pressure at each cylinder, maintaining uniform temperatures in all cylinders at all times.

When Fairchild began its researches into the air-cooled, in-line aircraft power plant, it began "from scratch." The formidable difficulty of air-cooling cylinders which were set one behind another had discouraged many. Interest had been diverted to radial air-cooled and liquid in-line design. Fairchild believed that the tremendous advantages of air-cooling combined with those of inverted, in-line arrangement were vital to this country's aeronautical progress. Fairchild spent a decade in the laboratory developing such an engine type . . . the Ranger. A simple yet amazingly efficient method of "pressure cooling" solved the primary problem. Today—the only engines of their kind in America—Ranger air-cooled, inverted, in-line engines are powering the planes of the United Nations. They are the most efficient and reliable engines in their power class. They not only justify in every respect the years spent in their development but, as with all Fairchild achievements in the science of aeronautics, they bear the unmistakable Fairchild "touch of tomorrow." Continuing researches demonstrate that they are the beginning of a new and brilliant chapter in aircraft engines and the planes which they make possible.

ON THE BEAM

"This government, the offspring of your own choice, . . . has a just claim to your confidence and your support." George Washington

RANGER AIRCRAFT ENGINES

Division of Fairchild Engine and Airplane Corporation • Farmingdale, Long Island

Young Man with Vision

by LEW TANSKY

Al Williams did more than win a race at St. Louis in 1923; he determined young Eddie Israel's future life.

MUCH like Young America of today, tousle-headed, freckled Eddie Israel looked up at the clouds and saw his future.

Since then, in a rollicking, unpredictable career, he has "almost made a million dollars," written and sold his life story for $10, shouted encouragement to a French air armada which was raining bombs around him. He has experienced the thrill of seeing his own planes, built with his grease-creased hands, carom to victory in nationally famous races. He has watched, with mingled feelings of awe, fear and disappointment, as others of his ships, products of months of hard work, plunged downward like stricken birds and crunched into the ground.

The red-haired youngster who once was called "the first aerial hitch-hiker," has come a long way since the days when he would grab a ride in anybody's plane, with no thought of destination. His saga of hopes and heartbreaks; ups, downs and in-betweens, typifies the post-market crash era when aviation and its men struggled impatiently against financial fetters. The men, many of whom averaged less than $10 a week as mechanics during the hard years but stuck to the industry, today are the backbone of America's production effort.

Thirty-year-old Eddie, too, is carrying his share, and preparing to take on greater responsibilities. His work with the flight test unit at Republic Aviation Corporation, Farmingdale, N. Y., has helped to make the P-47 *Thunderbolt* the formidable sky-sweeper that it is.

Eddie was born in St. Louis, Mo., March 16, 1912, of Irish-English parentage. At the age of 12, while school was out of session, he began helping his father, who conducted a highway construction enterprise. Mr. Israel envisioned his son a success in the business—but it was too late. Eddie had succumbed to the lure of the skies the year before, when the nation's leading flyers gathered at St. Louis for the Pulitzer races. Eddie and his brother, Gordon, who now is an engineer with Grumman, saw Al Williams whirl around the pylons at an average speed of 246 m.p.h. to win first prize.

"Up to then I had been interested in flying, but after that I became absolutely air crazy. I stored my model ships in the closet and went after the real thing. Anybody at the municipal airport could get his plane polished like a new dime—all for a 10-minute spin.

"In school all my English compositions and public speaking talks were on aviation and the teachers wondered how the devil they would be able to teach me anything else." Modestly, he adds, "Well, they didn't, but neither did anyone else."

One can't get much out of Israel by sitting down with him and pouring in the questions. At least not when the sun is shining. On rainy, murky days, when he and Lowry Brabham, test pilot, and Harold "Pop" Provo, hangar chief, are champing at the bits, waiting for the sun, Eddie's story can be pieced together. While scanning the skies for the ray that would mean resumption of activities in the operation's office, Eddie can be steered into an anecdotal mood.

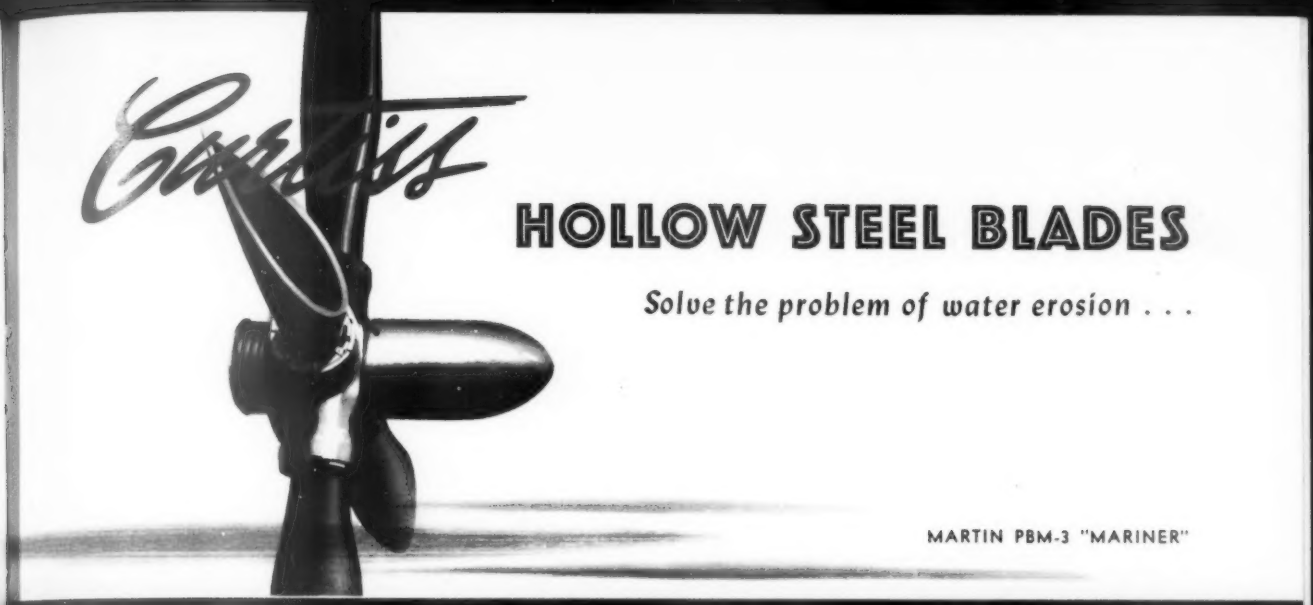
Now a flight section supervisor at Republic's Indiana plant, Eddie carefully checks each "Thunderbolt" before sending it up for its grueling flight test.

With his high school study in drafting, plus his ability to read blueprints (he acquired this at the age of 13 as a result of the construction experience), Eddie had no difficulty in obtaining a job as a draftsman with the Cleone Motor Company, which manufactured two-cycle, two-cylinder horizontally opposed engines for light aircraft.

Then came the big break. Benny Howard, his eyes on the 1930 Chicago national air races, selected Gordon Israel to build a racing plane for him. For five months, working nights and on rainy days, when he was able to get away from work, Eddie was at the Lambert Field, St. Louis, hangar, sawing and filing the pieces which ultimately became *Pete*. "With a displacement of 275 cubic inches, the 1,000 pound ship beat everything up to 1,000 cubic inches. It took five firsts, and the pot was $5,700," Eddie remembers.

This event opened a new vista for Eddie. "Racing looked like a pretty soft way to make a living." The day before

(*Continued on page* 105)



Curtiss

HOLLOW STEEL BLADES

Solve the problem of water erosion . . .

MARTIN PBM-3 "MARINER"

CURTISS

ELECTRIC PROPELLERS

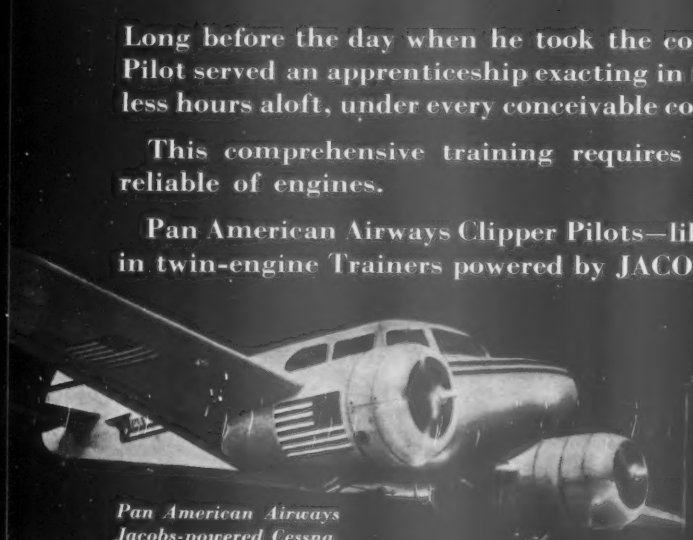
Training the CLIPPER PILOTS

with JACOBS AIRCRAFT Engines

Long before the day when he took the controls of this huge skyliner, the Clipper Pilot served an apprenticeship exacting in the extreme—an apprenticeship of countless hours aloft, under every conceivable condition, flying mostly "on instruments."

This comprehensive training requires Training Planes powered by the most reliable of engines.

Pan American Airways Clipper Pilots—like our Army Bomber Pilots—are schooled in twin-engine Trainers powered by JACOBS.



Pan American Airways Jacobs-powered Cessna.

JACOBS AIRCRAFT ENGINE CO.

POTTSTOWN · PENNSYLVANIA · U·S·A·

(*Continued from page* 102)

Christmas of 1931, he and Gordon launched a new project, *Redhead*. But it wasn't as easy as that. First they had to enlist the financial aid of their brothers, Clyde and J. W. "Jack" Israel, both of whom were in the construction business.

The first venture might have discouraged others, for *Redhead* and its owners went through months of bad luck before their faith in the ship brought rewards. On her maiden flight the *Redhead* slammed into the ground on landing. When Eddie reached the craft, the lifting cloud of dust showed that the landing gear, wings, prop and parts of the fuselage were beyond repair. Undaunted, the youths towed the wreck into the hangar and worked feverishly. September 1, 1932, saw the ship in Cleveland, ready (so the owners thought) for the races.

"The darndest thing happened while we were building *Red*," Eddie recalled. "We were so broke we didn't have carfare to get to the poorhouse. Then one day we got lucky. A tractor kicked me, spraining my wrist. I was out for 10 days. Soon after, I received an insurance check, for $41.41. Boy, I looked at that check as if it conveyed right, title and interest to the Bank of England. Forty bucks and change! 'Gordon,' I said, 'Crawl out from under the tail assembly and get a slick shine on your pan, because tonight we're going to bake the town brown.' "

No sooner had Eddie finished speaking than an express company messenger walked in. "I've got some tires and tubes for you fellows. Collect."

The brothers looked at each other, and thoughts of rivers of beer dwindled to brooklets. Eddie was the first to get up his courage. "How much?"

The messenger looked casually at his slip "$41.41."

Building of the *Redhead* was almost like a community project. During their spare time, mechanics and others around Lambert Field would walk into the Israel hangar, pick up a tool and begin to work. No pay was offered; none would have been accepted had it been offered. Then, as now, young Americans needed little or no remuneration when associated with a project which appealed to their strong competitive senses.

With Lew Bowen at the controls, the *Redhead* entered in the 550 cubic inch class, jumped into the lead at Cleveland. A half lap (three miles) later Bowen was forced to bring the plane down. It had become overheated. Discouraged but determined, the brothers improvised a system by which oil lines were run outside the ship and a large oil tank installed. Nonetheless, the craft made forced landings in three more Cleveland races.

The youths left the city without picking up a dime in purses. Later they discovered that their inexperienced eyes had failed to detect a flaw in the crankcase. It had been bent in the St. Louis crash. A bearing journal out of line, causing excess pressure on one side of the case resulted in the overheating.

"The fastest ship in the 550 class was clocked at 214 in the races. In trials, we got *Redhead* up to 221," Eddie reminisced.

One of the Israel trips was sponsored by the Wellston, Mo., Junior Chamber of Commerce. Following presentation of $200 raised by the chamber, a strange caravan left for Los Angeles. On a one and one-half ton truck the *Redhead* was packed, while on a trailer was a ship Ben Howard was entering in the West Coast races. The brothers and Eddie Fisher, Howard's mechanic, rode continuously for four days and four nights, alternating in use of the "bedroom," which was a mattress spread under the fuselage of the *Redhead*. At Los Angeles, Eddie and Gordon won $1,700; they had the engine overhauled immediately, at a cost of $1,200.

Redhead began her career with a crack-up and ended in a washout. In the spring of 1934, she broke the Omaha record in the 550 class and smashed up on landing.

Eddie, occasionally returning to construction work for sustenance, had a hand in the building of *Mr. Mulligan*, the Howard craft which won the Bendix transcontinental from Los Angeles to Cleveland. Ben was at the stick, with Gordon the co-pilot. Ben and Mrs. Howard were attempting to make it two in a row for *Mr. Mulligan* in 1936. Flying from Floyd Bennett Field, N. Y., to Los Angeles, they were leading by three hours when they crashed at Crown Point, N. M. Each suffered two broken legs.

While his employer was being hospitalized, Eddie went to American Airlines, then to Stinson. "With American I tore the engines down and with Stinson I put them together."

His air racing career came to a close in 1937. He was a mechanic for Jacqueline Cochran when she established a women's speed record of 296 m.p.h. The builder of the 1XP she piloted [Seversky] offered Eddie a job at Farmingdale and got a prompt acceptance.

Looking back on his coming to Long Island, Eddie said, "When I got the chance to work on pursuits, I jumped at it. Again my luck was with me, because here at Republic I certainly have seen some sweet jobs leave our runways."

Even now when he stands, arms akimbo, on the edge of the field while a *Thunderbolt* wings its way into the sky, Eddie's eyes gleam as he sends it off with an almost unintellible jargon that goes something like this: "Get up there you barrel-bellied bohunk. You better behave, you sweet smelling son of a gun."

Only a peculiar type of ingenuity enabled Eddie to get along during his happy-go-lucky racing days. Once he was leaning against a hangar door at Lambert Field when a stranger asked him whether he wanted an air ride to New York.

"Certainly," Ed replied. "I've never been to New York."

The ship ran into a snowstorm and came down in a Buffalo lot. A Buffalo *Courier-Express* reporter, investigating, wrote a few sticks, minimizing the accident and playing up the passenger as the first aerial hitchhiker. Eddie and the pilot, the former without a sou, separated.

"I went down to the public library, borrowed some paper and wrote 30 pages about my career, mixing in the lives of famous flyers, and went to see the city editor. He must have been a great guy, because he looked at the copy, held his nose with one hand and wrote out a voucher for $10 with his other. I'm glad he had two."

Reading his own biography, with its "waif of misfortune" and other Israelian cliches, must have convinced Eddie that he needed some bolstering. After getting to Indianapolis, he wired home to

FLYING

"Will you check me in, please?"

THERE ARE FOX HOLES AND *FOX HOLES!*

Some fox holes spit fire and destruction. Others ring with the clang and clangor of production.

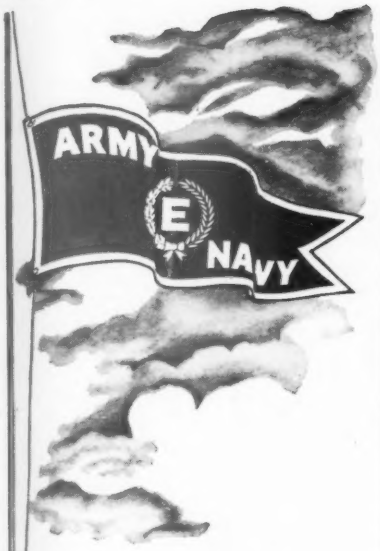
In the "fox holes" at Fleetwings, there's a task force of men and women that battles with sheets of stainless steel, aluminum and bonded plywoods. Pounding, riveting, welding, molding, they are forming from these materials, planes and plane parts—sturdy Fleetwings basic trainers, wings, fins, stabilizers, ailerons, fuselage sections, tail assemblies, and hydraulic equipment — "tools" to help carve Victory, a *winged* Victory, from the skies!

But today's battle is not all. For the day when Fleetwings' "fox holes" must be bulwarks in the fight to win the peace, our engineers have already drawn plans and blueprints. From these, there springs the promise that the pioneering of Fleetwings will continue—and contribute its share in seeing to it that American air power will never again be challenged.

FLEETWINGS

Incorporated

BRISTOL • PENNSYLVANIA



THERE'S a new flag flying from the flagstaff at Fleetwings' plant number one. Proudly floating beneath the red, white and blue is the red, blue, white and gold of the Army-Navy Burgee—symbol of the fighting spirit of Fleetwings' employees—loyal men and women, who by their production of vital aircraft parts have made an *active* slogan of

"KEEP 'EM FLYING!"

FLEETWINGS

Incorporated

BRISTOL • PENNSYLVANIA

instruct his family to sell his motorcycle and send him the money.

"Then I bought a TWA ticket and rode home like a doggoned general."

His brilliant account of his feats and those of others, was boiled down to a column and ran in a Sunday edition of the *Courier*. "Yeh," Eddie admitted, "they fumigated it."

Eddie probably is the only man in the world who compelled a prospective father-in-law to operate a tire pump for 500 miles.

They were driving through a sparsely populated part of Montana when the fuel pump on their Cadillac limousine broke. Eddie trudged several miles to a country garage, but learned that the place had no parts of the type needed. The garageman stared popeyed when Ed walked off again—carrying a 50 cent tire pump, 10 feet of air hose, an old inner tube and a valve. While D. M. Wood, his future father-in-law, looked on skeptically, Ed cut the tube into a gasket and sealed the gasoline tank vent.

After attaching the valve to the gasket, he used the hose to connect the valve and tire pump.

Then, while Ed drove, Mr. Wood sat in the back seat and pumped. Pressure forming at the top of the gasoline tank forced the fluid through the feed lines.

"When the Cadillac dealer in Salt Lake City saw our 'Rube Goldberg' he gave us a fuel pump for nothing."

Eddie's knowledge of physics principles might have earned him a tidy sum.

Like most auto drivers, he was exasperated frequently when the windshield wiper slowed or quit entirely when he depressed the accelerator. Noting that a vacuum tank with a check valve was used to operate the flaps on a Stinson, he developed a similar system for autos. The wiper swept the glass with an even stroke, whether the motor was idling or being accelerated.

"I figured I could make 85 cents profit on each unit, which would add up to a million bucks without much trouble, but then I discovered that the adaption came under patents issued to the Stewart-Warner company," he explained.

Matters which ordinarily would discourage people, such as losing out on a patent, or being too late at the finish line of an air race, have only a momentary effect on Eddie. Then he plunges into something new. That probably explains his absorption in the ground phases of aviation. He had intended to become a pilot. Soon after *Pete's* triumphs in Chicago, Ed felt that he was about ready for flight training.

"No," an eye specialist told him. "You'll have to stay on the ground."

"That's one thing that I couldn't take too easy," Ed confessed. He has more than 400 hours in the air as a passenger.

"As a matter of fact, I did pilot a plane once." Eddie's eyes lit up and one could sense that another anecdote was coming.

"It was right here at Republic. An executive, now gone, called me on a cold, blustery day and told me that he wanted the Laird, a stunt plane, taxied out. The ship was in among others, and it took me a good half hour of work to get it out. Then, I sat in the open cockpit, warming up the engine, mad because the wind and cold were biting my face.

"A few minutes later the executive came taxiing by in a nice heated cabin job. When he signaled that he didn't want the Laird, I was so mad I could have eaten him without salt. I gave my ship the gun just for the hell of it and at that moment a gust of wind lifted us and before I knew it I was five feet in the air and gaining altitude. I brought the ship down with a bang and went into the prettiest ground loop you ever saw. All I could do was sit, pray and feel sorry until the Laird straightened out."

As flight test foreman Eddie has realized some of his earlier ambitions. He has seen successive models and revisions come through; has helped Republic to build faster, more maneuverable and more powerful planes for the Army.

His ability was recognized in 1939, when he was sent by the company to Sweden to teach crews of the Royal Swedish Air Force to assemble the P-35's. While in Europe, he went through an air raid and almost killed a servant.

When the air raid alarm sounded in Genoa, Eddie, minding the warnings of wardens, hied himself to an air raid shelter. After sitting in the close space, Eddie, distracted by the bawling of children and wailing of women, climbed upstairs. Standing on the balcony of his hotel room, he drank champagne and shouted, "Give 'em hell, Frenchies."

"I never saw a more frightened woman in my life," Eddie exclaimed in telling of the Bucharest chambermaid incident. Ed, a golfer of notable inability, noticed a cane one morning in the corridor of the Athene-Palace hotel. He picked up the cane, swung back slowly in the best golfing tradition, and came down with a sharp powerful stroke. As he did, a sword shot out, flew the 50 feet to the end of the corridor, and with a thud imbedded itself in a wooden panel—only 12 inches away from the chambermaid! She had seen the weapon leave the cane, which had proved to be a type of scabbard, and had remained transfixed as the steel sped toward her.

Soon after his return from Europe, June 13, 1940, to be exact, Eddie and Miss Nancy Wood were married. This past April 14 found Eddie pacing hospital floors, chuckling at the arrival of his first-born, D. Wood Israel.

With the step-up in production entailing more hours of work, creating new problems to be licked, the serious side of Eddie asserts itself as he directs crews of men taking "bugs" out of ships. He has given up gags for the duration.

To what end all this experience, one might ask. Well, recently Republic officials were faced with a problem. They needed a man, a young man with vision —one who knew the make-up of the *Thunderbolt* far better than he knew the palm of his hand. One who had executive ability, who could get along with his personnel. Eddie was the answer. As this is being written he is on his way to Republic's new Indiana plant, as supervisor of the flight section.

END

SHORTENING SUPPLY LINES

Freight Planes Are Out of the Blueprint Stage and In the Air

As the production of industry mounts, the difficulty of getting guns, planes and tanks into the hands of fighting men on many and distant fronts climbs apace. Curtiss-Wright is helping to solve one phase of this problem with the air freighter. Giant cargo ships are rolling out of their plants to join the steadily growing fleet now in service.

Haskelite welcomed another opportunity to contribute its share to the war. For, as in bomber-trainer planes of plywood, it was Haskelite again who supplied much of the material (both direct and as a primary source for the producers of the wings and fuselages).

Haskelite, in the business of creating structural plywood, has consistently led in the development of new laminated products. Their distinction has been to supply wood in forms which meet strict engineering requirements and lend themselves to mass production.

Plymold, the most recent development, is especially remarkable in the mass output of planes. Large plane sections are being molded in compound curvatures and accurately varied thicknesses.

The manner in which Haskelite's research successfully met the demands of war production suggest it should pay your company to keep in touch with Haskelite products and processes.

HASKELITE MANUFACTURING CORPORATION
GRAND RAPIDS, MICH. • DETROIT, MICH. • NEW YORK CITY • CHICAGO, ILL.

HASKELITE

PLYMOLD MARINE PLYWOOD Plymetl

AIRCRAFT PLYWOOD Phemaloid

Industrial Aviation SECTION

Martin guardettes (left) march to individual posts. Note police "billys" at waist. They know how to use them. All employees are stopped (above) and lunch boxes inspected.

PLANT PROTECTION IN WARTIME

THE protection of buildings and equipment against sabotage during wartime is of vital importance to every industrial plant. The aviation industry has taken full cognizance of the necessity of maintaining a 24-hour watch. Typical of the steps taken and organizations created to handle this protective work is the set-up at the huge Glenn L. Martin Company plant, Baltimore, Md.

Through a program of organizing and training that began long before Pearl Harbor, every square foot of grounds or of floorspace owned or leased by the company is patrolled day and night by armed and trained men and women who form the guard force—several hundred strong—of the Protection Department.

The over-all job of the guards is to protect war material, premises and utilities from injury or destruction by the enemy or otherwise—a gigantic undertaking that breaks down into dozens of such subsidiary tasks as guarding against fire, checking the credentials of every person who enters the plant areas, controlling motor and foot traffic and maintaining order at all times.

The authority of the guard force is as far-reaching as its tremendous responsibility: besides being employees of the company, all guards are sworn in as special policemen of the State of Maryland and as civilian auxiliaries of the United States Military Police. In the event of an air raid or other extreme emergency, they would act directly under the orders of the United States Army, and would be subject to court martial

Capt. L. P. Buchman, chief of the Martin plant protection organization, has taught his crews to hit what they aim at.

for failing to carry out any such orders to the letter.

In accord with the critical nature of their duties, involving as they do the protection of the country's very sinews of war, guards are carefully selected and trained. Each man or woman must pass rigid physical examinations, conform to certain educational standards and stand a thorough character investigation both by the company and by the Maryland state police.

Organized on a military basis, the force consists of two companies of three platoons or shifts each. The chief of protection, E. A. Schurman, commands the force as a whole. Each company has a captain and each platoon a lieutenant and two or more sergeants. Company No. 1, commanded by Capt. L. P. Buchman, who is also assistant chief of protection, guards plant 1, all warehouses and storage places in and about the city, and the Fallsway, Canton, Sinclair and Redwood Divisions. Company No. 2, commanded by Capt. G. M. Sweet, protects plant 2, the airport and hangars.

The entire force undergoes periodic instruction in the use of firearms on the pistol range, military drill under the new manual, and instruction in military courtesy and in the scope and extent of their responsibilities as auxiliaries of the military police.

Recruits, besides receiving this periodic instruction along with the rest of the force, undergo constant direct training by their officers and experienced veterans. They master such details as the workings of the watch tour and fire alarm systems, the geographical layout of the plants and buildings, the work and lunch periods of all departments, the traffic and parking lot systems, the operation of the badge and identification-card system and the methods of inspection and control of all persons or things entering or leaving the premises.

In training and technique all of this represents a tremendous advance over the average industrial policing of a few years ago. Those were the days of the old-fashioned gatehouse presided over by the faithful old pensioner who remembered when this or that executive started out as a workman. The atmosphere of the gatehouse was leisurely, philosophical; its marks were the padded chair, the coal stove, the lantern, the old fellow's pipe and big can of tobacco.

In their place now stands the modern entrance, controlled by guards physically vigorous, mentally alert, neatly uniformed and armed, and charged with multifarious technical duties. The politeness is still there, but so is alertness: millions of dollars in fighting equipment and machines that build fighting equipment must be protected from possible smooth-talking spies, saboteurs, fifth-columnists and cranks.

The new techniques are of course now more or less common to warplants, but the Glenn L. Martin Company had a large hand in pioneering them. Chief Schurman joined Martin to organize the set-up after having headed the Florida State Police and the uniformed force of the United States Secret Service. He has published a 141-page book, "Plant Protection," outlining the techniques now standard.

Another important Martin contribution to the science of plant protection was the pioneering of the employment of women guards. At the time the efficient corps of Martin uniformed women guards came into existence, many problems of organization and policy, now settled, were baffling enigmas.

More men and women work in Plants 1 and 2 alone than live in any city of Maryland except Baltimore. The guards are impressed at all times with the fact that it is their task, besides protecting the plants and equipment, to contribute to the comfort and safety of the thousands of persons who operate them. This they do by enforcing, courteously and efficiently, the rules that are necessary when so many people are working and moving within a limited area.

WOMEN LEARN QUICKLY

Cleaning the fins of a "Cyclone" head.

IN line with its plans to employ 20,000 additional women the Wright Aeronautical Corporation is taking women with no previous shop experience and, through individual instruction, is enabled to place many into production shops immediately. The woman worker shown above is receiving instruction in the use of a burring tool to clean up the fins of a *Cyclone* head as it comes from the foundry.

PLASTIC STANCHIONS

Aluminum mast fits over plastic stanchion.

PLASTIC radio mast stanchions are being used on the Bell Airacobra (P-39), saving the use of a large aluminum casting. The mast stanchion is attached to the fuselage and over it is fitted an aluminum mast.

Dependable Help!

FOR MEN CONCENTRATED ON AN OBJECTIVE...

U.S. AIR CORPS PHOTO

ANTI-VIBRATION

LITTELFUSES

Millions of Littelfuses are in all branches of the Services—meeting to-day's unprecedented demands with NEW design and construction.

Terrific vibration and shock, sudden temperature changes from 60° below zero to 120 above, are withstood by exclusive Littelfuse factors.

Littelfuse Depolarization (illustrated below),

Littelfuse "Gooseneck," spring-forming at end of element, taking up contraction and expansion,

Littelfuse Locked Cap Assembly, sealing element against "perspiration," and preventing caps from ever loosening.

Mechanically Depolarized FUSE ELEMENT

Twisted at 90°, Littelfuse elements are mechanically depolarized—protected against vibration from any direction. Hold against tests 10 times worst field conditions. Littelfuse of 5 amps., or less have spring-and-link element.

"Littelfuse—first in Aircraft Fuses—Pioneers in the Industry"

LITTELFUSE INC.

4793 Ravenswood Ave., Chicago, Ill.

C26S—Shielded

CHAMPION SPARK PLUGS

which fire at high altitudes and under extremely high pressures in our "hottest" bombers and pursuit ships have exceptional quality of materials, design and workmanship which accounts for their extreme dependability. These very same qualities are inherent in all Champion Spark Plugs.

C26—Unshielded

It takes 112 Champion Spark Plugs to "plug up" a Flying Fortress. And each and every one of them has a real job to do. They fire at a faster rate than the machine guns with which it bristles, and for hours on end, instead of mere minutes. They must fire at pressures and temperatures not encountered in normal engine practice, and they must be so dependable that pilot and crew don't have to give them a thought.

Champion Spark Plugs are filling that rather large order with characteristic distinction. They are being widely used in aircraft engines of every size and type in use by our air forces, and they are piling up records for long life and dependability, hitherto unequalled.

Characteristic Advantages of Champion All Ceramic Insulated Spark Plugs Are:

1. Immunity from heat and chemical reactions.
2. Freedom from fuel, oil, or moisture absorption which causes "shorts."
3. Inherently high heat conductivity with consequent wider range between pre-ignition and fouling.
4. Absolute uniformity of material.
5. Homogeneous structure eliminates air spaces which cause current leakage.
6. Easily cleaned and serviced—no specialized equipment or factory returns necessary.
7. Scientifically controlled manufacture.

Crew works on head heated to 650° F.

HOT WORK

WORKING with an aluminum cylinder head heated to 650° F., workers of the Lycoming Division of the Aviation Corporation perform a dozen operations on the metal in 76 seconds—before the head has cooled 15°.

The workers, a three man crew, insert bronze intake and exhaust valve seats, place spark plug bushings in position, secure a permanent seal at these places, screw into place a molybdenum steel forged cylinder barrel, insert intake and exhaust value guides, and drive into place steel rocker arm bushings. The completed unit is then water-tested at 450 pounds per square inch.

PROPOSE MERGER

MERGER of Consolidated Aircraft Corporation and Vultee Aircraft, Inc., creating one of the largest aircraft manufacturing enterprises in the world, will be voted on by stockholders at the annual meetings of the respective companies on March 17.

"The merger of the two companies has been under consideration since Vultee acquired 34 per cent of Consolidated's outstanding stock at the end of 1941. Winning the war is the sole objective now—and this means maximum aircraft production," states Tom M. Girdler, chairman of Consolidated and Vultee.

"Merger of Consolidated and Vultee, which together cover the entire range of planes from the largest bombers and transports to basic trainers and 'flying jeeps', will permit use of combined plant and personnel for all-out production of military airplanes."

Upon completion of the proposed merger the name of the new company will be Consolidated Vultee Aircraft Corporation.

NEW BENDING JIG

THE Scott Aviation Corporation has developed a semi-automatic copper tubing bending jig which is so simple to operate that a woman can easily handle this phase of production. The jig is the result of a demand for rapid and accurate bending of high pressure copper tubing for aircraft installations at a rate greatly exceeding the capacity of hand bending.

Special costume for sub-zero test work.

FISH BOWL BONNET

WHEN the Republic P-47 *Thunderbolt* fighter plane pokes its snub nose high into the cold, rarefied air miles above the ground, its parts, assemblies and liquid solutions continue to function properly as the result of previous testing in this ice box, where the temperature can be dropped to 92° below zero. Research testers are provided with special apparel. Air is pumped from the outside into the "fish bowl" in which his head is enclosed.

DARNELL CASTERS
& E-Z ROLL WHEELS
Reduce Floor Wear to a minimum.
Increase efficiency of employees.
Eliminate wracking of equipment.
DARNELL CORP. LTD.,
LONG BEACH, CALIFORNIA,
60 WALKER ST., NEW YORK, N.Y.
36 N. CLINTON, CHICAGO, ILL.

NEW RIVET REDUCES PLANE WEIGHT

ANOTHER war production victory has been achieved through the development of a super-hard rivet strong enough to replace bolts on aircraft or other structures, it is announced by North American Aviation, Inc.

The new rivet, one of the aircraft industry's many important wartime contributions expediting warplane production, has considerably lightened the weight of the famous "laminar flow" wing of the P-51 *Mustang* fighter.

Use of the new rivets, it was disclosed, has effected a 60 per cent weight reduction in relation to the equivalent bolts and rivets previously used. Such an important weight reduction is particularly valuable in a combat airplane design like the *Mustang*.

Nearly 1,000 of the new rivets, which can be installed five times faster than bolts, are used in the *Mustang's* wing, replacing a large number of regular rivets and 798 heavier bolts.

The secret of the new rivet, which has been named the "Hi-shear" rivet, is in the method of installation. With a shear strength of 75,000 pounds per square inch, compared with a normal rivet's shear strength of 25,000 pounds per square inch, the Hi-shear rivet is too hard to be driven in the usual manner.

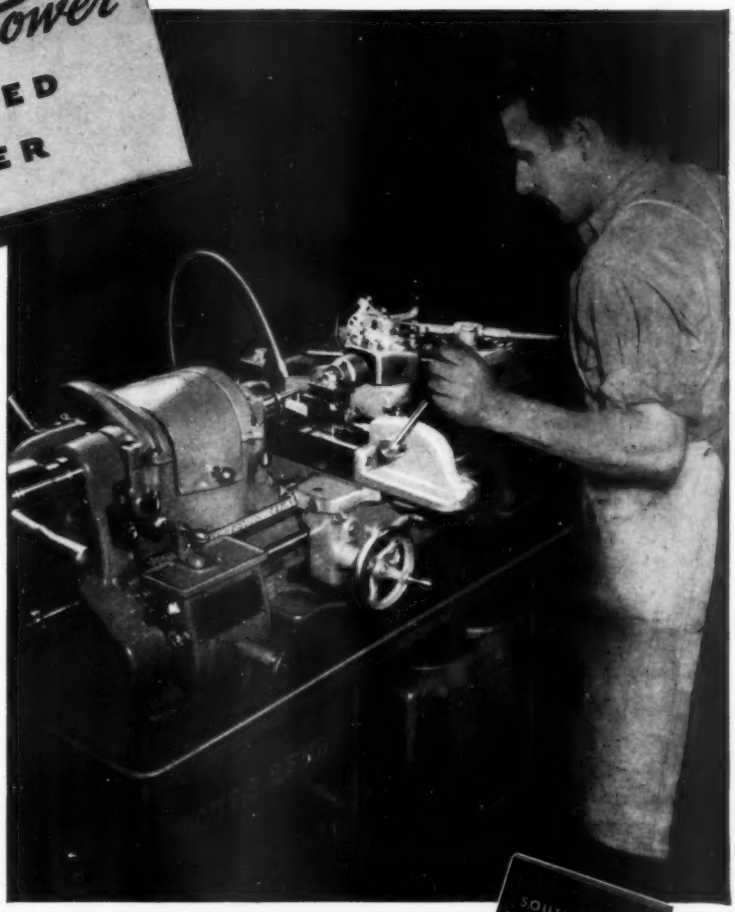
Instead, it is "riveted" into place by a special tool that presses a tiny aluminum alloy collar into the notched end of the stud, leaving a modified conical head. Excess length of the collar is sheared off automatically by the tool during the operation by pressure against the sharp edge on the tip end of the stud.

The new rivet was developed by George Wing, a North American Aviation engineer, who also invented a special tool employed in the riveting operation.

The new rivets are used in parts subject to shear loads, where it previously was necessary to employ bolts. The rivets come in two styles of heads, in several diameters and in lengths to suit all conditions.

Two or more regular rivets are required to equal the strength of one Hi-shear rivet, it was revealed.

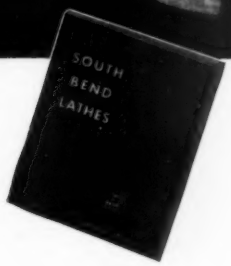
MORE *Producing Power* FOR SKILLED MANPOWER



Skilled manpower is one of the most critical of all our strategic resources. To give our fighters the added striking power of more and better weapons, our skilled workers need the producing power of more efficient tools.

Machine tools that are inefficient because they are hard to operate, inaccurate, or incapable of delivering the required speeds are wasteful of critical manpower. Wasted manpower is lost production—and victory jeopardized!

Give your skilled manpower more producing power with South Bend Lathes. Designed and built to deliver maximum production with minimum effort, they are highly efficient on a wide variety of precision machine work. Their ease of operation reduces fatigue and seemingly shortens the workday by hours. This is accomplished through conveniently placed, smoothly operating controls—clear-cut, easy reading graduations—fully enclosed design with no exposed pulleys, belts, or gears—and dependable precision that permits top speed production, even when tolerances must be held to extremely close limits.



SOUTH BEND LATHE CATALOG

The entire line of South Bend Lathes is described in Catalog 100C. Write for your copy of this new 48 page catalog.

Army—Navy Production Award with Star presented to the South Bend Lathe Works for outstanding war production.

SOUTH BEND LATHE WORKS LATHE BUILDERS FOR 38 YEARS SOUTH BEND, INDIANA

ELECTRIC INDUCTION SPEEDS OUTPUT

HEATING a propeller blade shank for two important forming operations in approximately one-fifth the time formerly required, is one of the important time-saving procedures adopted in warplane production.

The propeller shank is heated by a process of electrical induction, a streamlined method originated and perfected by The Ohio Crankshaft Company of Cleveland, O.

The shank of the hollow steel propeller blade is first heated preparatory to swaging, an operation in which the shank is rounded to a perfect circumference.

The blade is mounted on a movable rack at the front of the machine. The tubular shank section, 4⅝ inches in diameter at the base of the blade, is then moved forward until it is surrounded by the heat inductor coils of the unit.

When the operator presses the control button, electrical current of high frequency flows through the inductor coils. This sets up an enormous amount of internal molecular friction in the 12⅝-inch section of the steel propeller shank, heating it to approximately 1,700° Fahrenheit in 150 seconds.

When the correct temperature is reached, the operator hooks the blade on an overhead spring balance crane and conveys it to a huge National forging machine capable of producing a 27-ton pressure.

Propeller blade shank being heated to 2,200° F. in 210 seconds, one-fifth usual time.

With the shank positioned in the dies of the machine, the operator depresses a foot lever, thus opening and closing the dies in quick succession. Each time the dies open, the operator turns the propeller shank about one-quarter of a revolution. As pressure is thus applied around the entire circumference of the shank, it is swaged into a true cylindrical shape.

At the completion of the swaging operation, the blade passes through two welding processes, a thorough inspection and a lathe machining operation before it is again mounted on the movable rack and heated a second time in the unit for 210 seconds to a temperature of about 2,200° Fahrenheit.

When the proper heating is attained, the overhead crane again conveys the heated piece to the adjacent upsetting equipment in a few seconds.

The upsetting operation consists of forming the heated shank in a three pass set of dies to increase the wall thickness of the shank from .520 inches to approximately 1³⁄₁₆ inch, and to decrease the length of the shank area from 12⅝ inches to 9³⁄₁₆ inches.

Prior to the adoption of the "Tocco" principle, the blade shanks were heated by means of gas furnaces. Fifteen minutes were required for heating to the desired temperature, and color of the heated work was the only way in which the operator could judge whether the correct temperature had been reached.

ELLINGTON IN NEW YORK

KEN ELLINGTON has been appointed director of information for the Aircraft War Production Council, East Coast, Inc. Prior to taking his present job, Ellington was public relations and radio executive of the Aeronautical Chamber of Commerce.

HT-4B

HERE is that high-powered rig you have always wanted to own . . . one that you can depend upon for peak operating efficiency. Hallicrafters have built into the HT-4B the resultant experience from years of engineering research.

Model HT-4B delivers a carrier output of 325 watts on phone and 450 watts on CW. The preamplifier supplied with the transmitter can be mounted conveniently at the operating position, controlling volume, keying and standby . . . once adjusted to any band the rig may be operated remotely.

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ARMY NAVY

LIFE RAFT EJECTOR

Water contact opens trap, inflates boat.

PILOTS forced down at sea ordinarily haven't time to get both themselves and their life rafts away from the plane before it sinks. Often, in cases like this, the pilot must rely on his life belt alone to keep him afloat. The Walter Kidde Company of Bloomfield, N. J., has patented a device which will automatically launch the life raft whenever the plane strikes the water.

This new invention employs a water sensitive switch on the underside of the fuselage which automatically opens the release valves on two cylinders of carbon dioxide. The first bottle opens a hatch of the raft compartment at the rear of the cockpit and the second inflates the raft. Manual controls are provided to supplement the water switch arrangement.

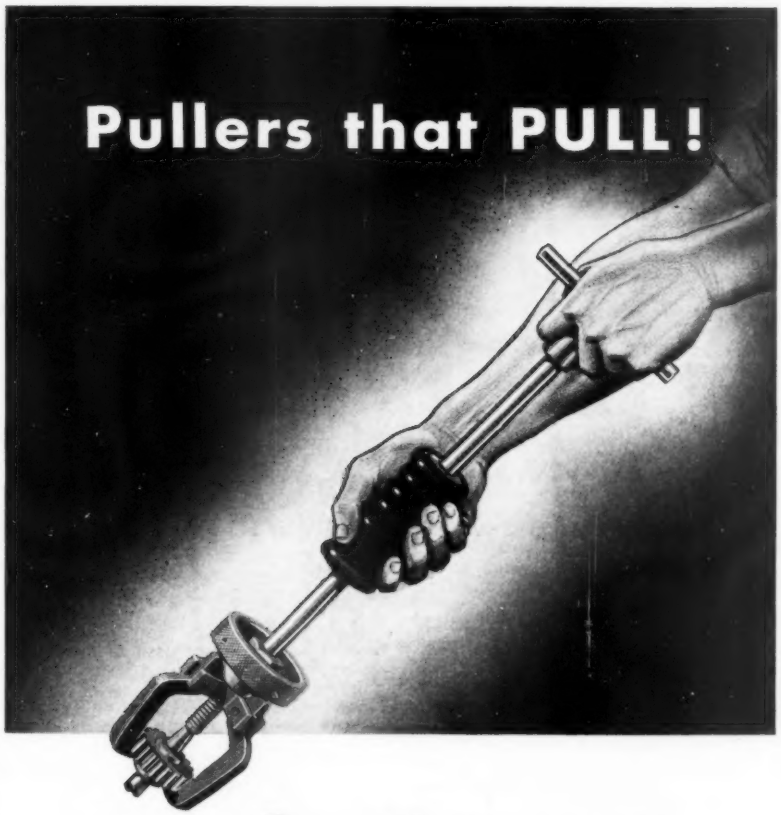
NEW CHEMIGUM USE

SUCCESSFUL adaptation of synthetic rubber to the "nerve centers" of military and commercial airplanes has been achieved by the Goodyear Tire & Rubber Company, whose engineers have perfected a Chemigum of sufficient flexibility and resilience to warrant the replacement of other types of compounds for use in hydraulic accumulators.

The accumulator of an airplane is the reservoir in the heart of a plane's hydraulic-control system from which reserve fluid for all purposes is drawn automatically when needed. The synthetic rubber diaphragm within the accumulator separates the air, via which pressure is exerted, from the reserve fluid supply.

MANPOWER POOL?

POSSIBLY tapping a new source of manpower, Douglas Aircraft Company has been conducting a wholesale newspaper, radio and billboard campaign to recruit Mexican and other Spanish-speaking workers living in the Los Angeles area. Douglas already is employing scores of Mexican workers, according to S. O. Porter, director of personnel.



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To supply the demand for Plomb Tools in war industries, 36 plants now make them in ever increasing volume. This permits a two-fold service. If you need specially designed tools for hard-to-get-at war production problems, in quantity, consult the Plomb Tools Contracting Company Division. For regular tools, contact the Plomb dealer in your locality.

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Letters

The Navy Issue

Sirs:

"Officers of the Bureau of Aeronautics already have found many uses for it. Moreover both here at home and in the foreign countries to which it will be sent, this issue's articles and interesting photographs will, I know, do honor to the Navy Air arm."

JAMES FORRESTAL
Under Secretary of the Navy
Washington, D. C.

Sirs:

"I am greatly pleased with the U. S. Naval Aviation at War issue of FLYING. The arrangement and illustrations are excellent, making it truly enjoyable reading as well as valuable as a historical record. Please accept congratulations."

R. J. MITCHELL
Major General, USMC
Division of Aviation
Washington, D. C.

Sirs:

"It is indeed a most comprehensive and valuable piece of work."

JESSE H. JONES
Secretary of Commerce
Washington, D. C.

Sirs:

"It is executed in a very interesting and informative manner and gives a grand impression of the striking power of our air forces."

DONALD M. NELSON
Director
War Production Board
Washington, D. C.

Sirs:

"It seems to me that you contributed a significant service in presenting to the American public the story of Naval aviation. The entire issue was excellent, and the colored and duotone photographs unusually good."

A. C. READ
Rear Admiral, USN
Naval Air Technical Training Command
Chicago, Ill.

Sirs:

"It is certainly up to your usual standards in this form of publication and I can pay you no higher praise."

H. N. THORNTON
Air Commodore
Air Attache
British Embassy
Washington, D. C.

Sirs:

"I have enjoyed reading the interesting articles and looking at the wonderful pictures which go to make this issue one of the best publications of its kind I have ever seen. The work which your company has done to publicize the Naval aviation arm in this issue is in keeping with the excellent results it has obtained from its efforts to publicize the various branches of the armed forces which have heretofore received very little of their deserved recognition."

DAWSON OLMSTEAD
Major General, USA
Chief Signal Officer
Washington, D. C.

Sirs:

"I had an opportunity to look this over last night and congratulate you on the fine job done. I am sure it will be very useful to us in the Navy here, and brings together a lot of information in one place which will give the public a much better idea of the Navy air program."

RALPH A. BARD
Assistant Secretary of the Navy
Washington, D. C.

Sirs:

"Allow me to congratulate you on the comprehensive and painstaking job you have done on the U.S. Naval Aviation issue of FLYING magazine. Contemporary writing and compilation of this kind means that historians will have excellent material to turn to in the years to come. In other words, it's a job for the ages!"

HARRY WOODHEAD
President
Consolidated Aircraft Corp.
San Diego, Calif.

Sirs:

"Permit me to felicitate you on compacting in one elegant volume so much exact and authoritative information; also in securing such generous cooperation from the aeronautic officials of the United States Navy. This opportune issue will have the enthusiastic perusal of staff members and readers in the Aeronautic Division of the Library of Congress."

A. F. ZAHM
Chief
Division of Aeronautics
Library of Congress
Washington, D. C.

Sirs:

". . . I am terribly impressed with the overall quality as well as with the extremely interesting material which it contains. I am taking it home where I will have the opportunity of going through it more carefully. The dissemination of this kind of information certainly will be an important help in the creation of a better understanding about a very important aspect of modern warfare."

WILLIAM S. PALEY
President
Columbia Broadcasting System
New York, N. Y.

Sirs:

". . . in my opinion it is a distinct contribution to aviation in general and Naval aviation in particular."

E. J. KING
Admiral, USN
Headquarters, Navy Department
Washington, D. C.

Sirs:

"I wish to compliment you on the constant improvement that you have made in FLYING as to editorial matter, illustrations and news coverage. I have been a subscriber for a number of years and have noticed the improvement of the entire publication with interest. I wish to compliment you more especially on your February issue, showing U.S. Naval Aviation at War. This particular issue is one of the finest issues of any aviation magazine I have seen published and it is my intention to preserve this particular copy of mine in my library for future reference. I was educated at the Naval Academy and know personally a number of the officers writing the various articles in this particular issue and they are all

FLYING

Smooth take-off IN AMERICA, Safe Landing IN AFRICA!

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Transport planes of Pan American Airways' famed Africa-Orient division are equipped with Aerols, including dual-tired main legs. Thanks to Aerols, those huge cargo carriers take off with effortless ease from Florida runways. Laden with vital war materiel, they soar safely above sub-infested ocean, tropical jungle and desert sands. Finally at a remote African base, these planes make soft, cushioned landings on Aerols. Plane, crew and cargo are completely protected.

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very, very competent men. Every member of the U.S. Navy air forces should have a copy of this magazine. It would tend to increase his pride in that branch of the service of which he is a member."

J. L. HAMILTON
President
Sportsman Pilots Association

Chicago, Ill.

Sirs:

"It so happens that my 21-year-old son who has just been accepted by the Navy as an aviation cadet had marked a copy of this issue and had gone over its contents with me reflecting great enthusiasm. It is his purpose to read every article complete. I must admit that this has also been my advice to him. You are to be congratulated in getting out so worthwhile an issue. It should be of great assistance to the Navy and to young men contemplating entering the Navy."

J. F. VICTORY
Secretary
National Advisory Committee for Aeronautics

Washington, D. C.

Sirs:

"I have examined this issue with great interest and want to congratulate you upon the fine service which you have rendered to all those interested in aviation. The book is a mine of information both useful as a reference book and valuable also because of the outstanding articles which it contains."

L. WELCH POGUE
Chairman
Civil Aeronautics Board

Washington, D. C.

Sirs:

"This issue has evidently been most carefully prepared, both in the selection and editing of the material and in the composition and reproductions of the issue. It is of great technical and educational benefit at the present time and will, doubtless, be an important item in the historical records of aviation and of the American war effort."

G. L. VAN DEUSEN
Brigadier General
U.S. Army

Fort Monmouth, N. J.

Sirs:

"It is indeed a distinguished edition . . ."

N. H. MASON
Congressman from Illinois

Washington, D. C.

Sirs:

"I am finding it extremely interesting and its composition is splendid . . .

"As Chairman of Naval Appropriations, I naturally have considerable interest in publications of this type and you . . . should be complimented in giving to the American public FLYING."

HARRY R. SHEPPARD
Congressman from California

Washington, D. C.

Sirs:

"I think you . . . are to be congratulated upon the success of this most attractive issue. When I say this, I refer to both the editorial and mechanical makeup of this magazine. The articles are exceedingly interesting and informative and the section devoted to color photography is one of the most attractive to have come to my attention. You may well be proud of your achievement in this connection."

ARTHUR CAPPER
Senator from Kansas

Washington, D. C.

Sirs:

"This is a most comprehensive, beautifully arranged publication, the contents of which I have received sincere enjoyment in reading."

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Congressman from Idaho

Washington, D. C.

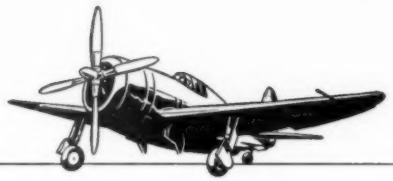
Sirs:

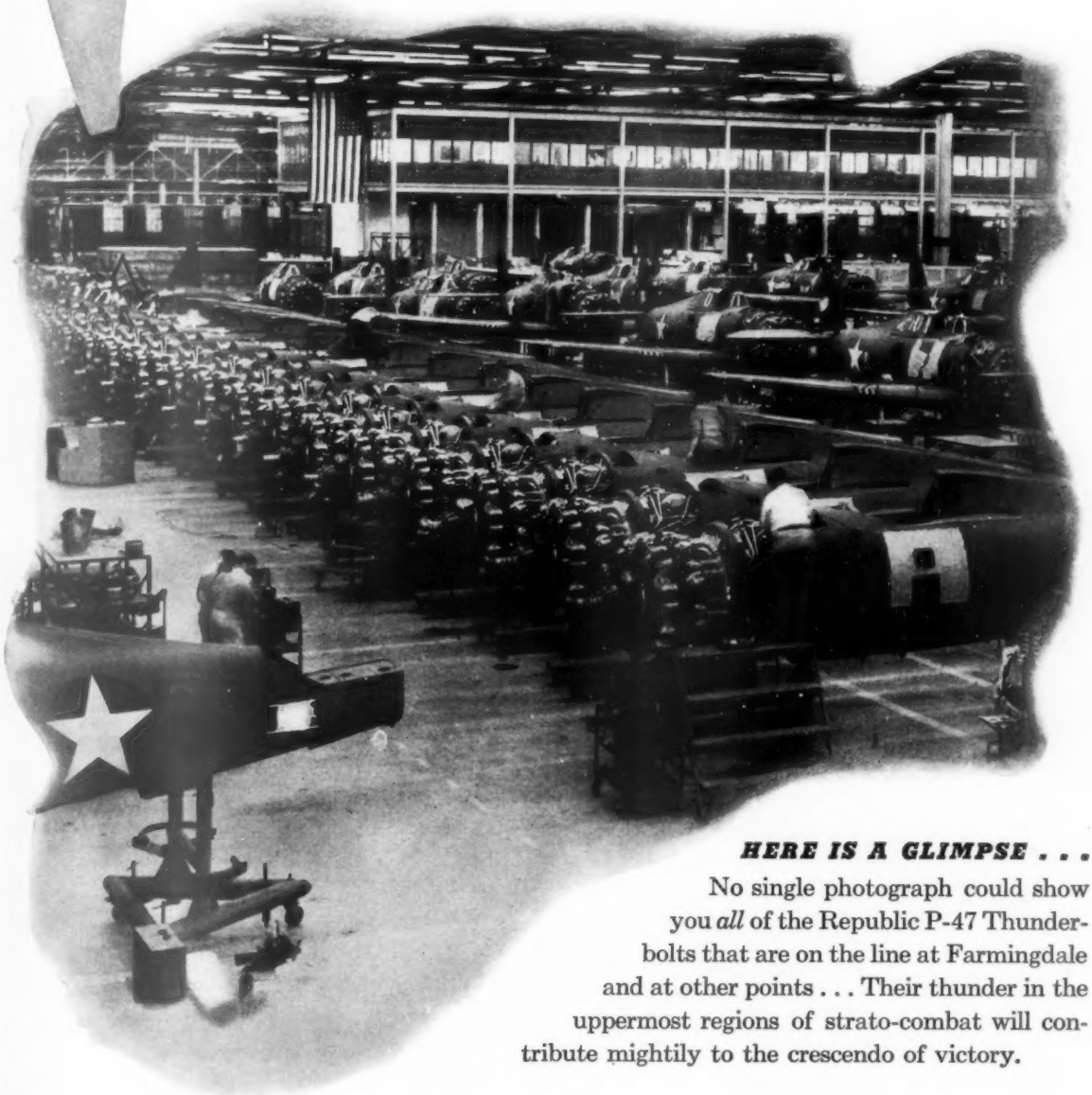
"I have thumbed through the volume casually and feel sure that it will prove not only extremely interesting, but very valuable, and I certainly will take the time to peruse it more minutely."

BEN LEAR
Lieutenant General
U.S. Army

Memphis, Tenn.

V OLUME FOR VICTORY





HERE IS A GLIMPSE . . .

No single photograph could show you *all* of the Republic P-47 Thunderbolts that are on the line at Farmingdale and at other points . . . Their thunder in the uppermost regions of strato-combat will contribute mightily to the crescendo of victory.

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"As usual—FLYING comes up to its high standard of quality and extent of information."
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Manager
Aviation Department
Los Angeles Chamber of Commerce
Los Angeles, Calif.

Sirs:
"It is a great edition and most informative. I am sure that it will help the American people better to understand Naval aviation's problems and its part in the war."
MELVIN MAAS
Congressman from Minnesota
Washington, D. C.

Sirs:
"Your volume is a very valuable one and splendidly gotten up. It will be a source of enjoyment to me for a long time to come."
L. SHELDON, Jr.
Rear Admiral, USN
Assistant Chief of Bureau of Medicine and Surgery
Washington, D. C.

Sirs:
"Not only is it an invaluable record Naval aviation, but its outstanding collection of pictures forms an excellent cross-section of the work of Navy photographers."
CARLETON MITCHELL, JR.,
Lieutenant, USN
Officer in Charge
Combat Photography Section
Washington, D. C.

Sirs:
"It impressed me as one of the best publications on the subject that I have seen."
HARRY S. TRUMAN
Senator from Missouri
Washington, D. C.

Sirs:
". . . It is indeed a distinguished issue and I have turned it over to our library so that it may be available to the personnel of this Bureau. I feel that in this issue you have offered your readers a very accurate and interesting stimulating account of a most timely subject."
T.D. RUDDOCK
Rear Admiral, USN
Bureau of Ordnance
Washington, D. C.

Sirs:
"It is an outstanding piece of work and I am placing it along with the . . . copy of my Royal Air Force issue. These are to be carefully preserved for the day when my youngsters who are both aviation minded may be able to look back and in some measure realize the price of freedom and victory."
PAUL D. HILEMAN
Thompson Products, Inc.
Bell, Calif.

Sirs:
"This volume will become a valuable reference book, and I am looking forward to studying it at my first opportunity."
WILLIAM D. LEAHY
Admiral, USN
Washington, D. C.

Sirs:
"I found it most interesting and a very valuable source of information."
FELIPE MUNILLA
Lieutenant Colonel
Military and Air Attache
Cuban Embassy
Washington, D. C.

Sirs:
"I have read it with utmost interest."
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"It is a very attractive publication. It has a tendency to build up morale and to stimulate the patriotic spirit of our people."
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Washington, D. C.

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"It is a beauty. I have perused its contents with a great deal of pleasure and satisfaction. The dissemination of information which this volume contains should go a long way towards helping the civilian morale and boosting confidence in the air arm of our Navy."
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Rear Admiral, USN
The Judge Advocate General
Navy Department
Washington, D. C.

Sirs:
"Your volume has come off the press at a most opportune time, and certainly is all-inclusive in its write-up of the different planes and squadrons. It should prove most interesting and informative to everyone and I value my copy very highly."
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Commander, USN
Division of Aviation Training
Bureau of Aeronautics
Navy Department
Washington, D. C.

Sirs:
"You have done a remarkably fine and thorough job of bringing together much information that will be valuable and interesting to the industry."
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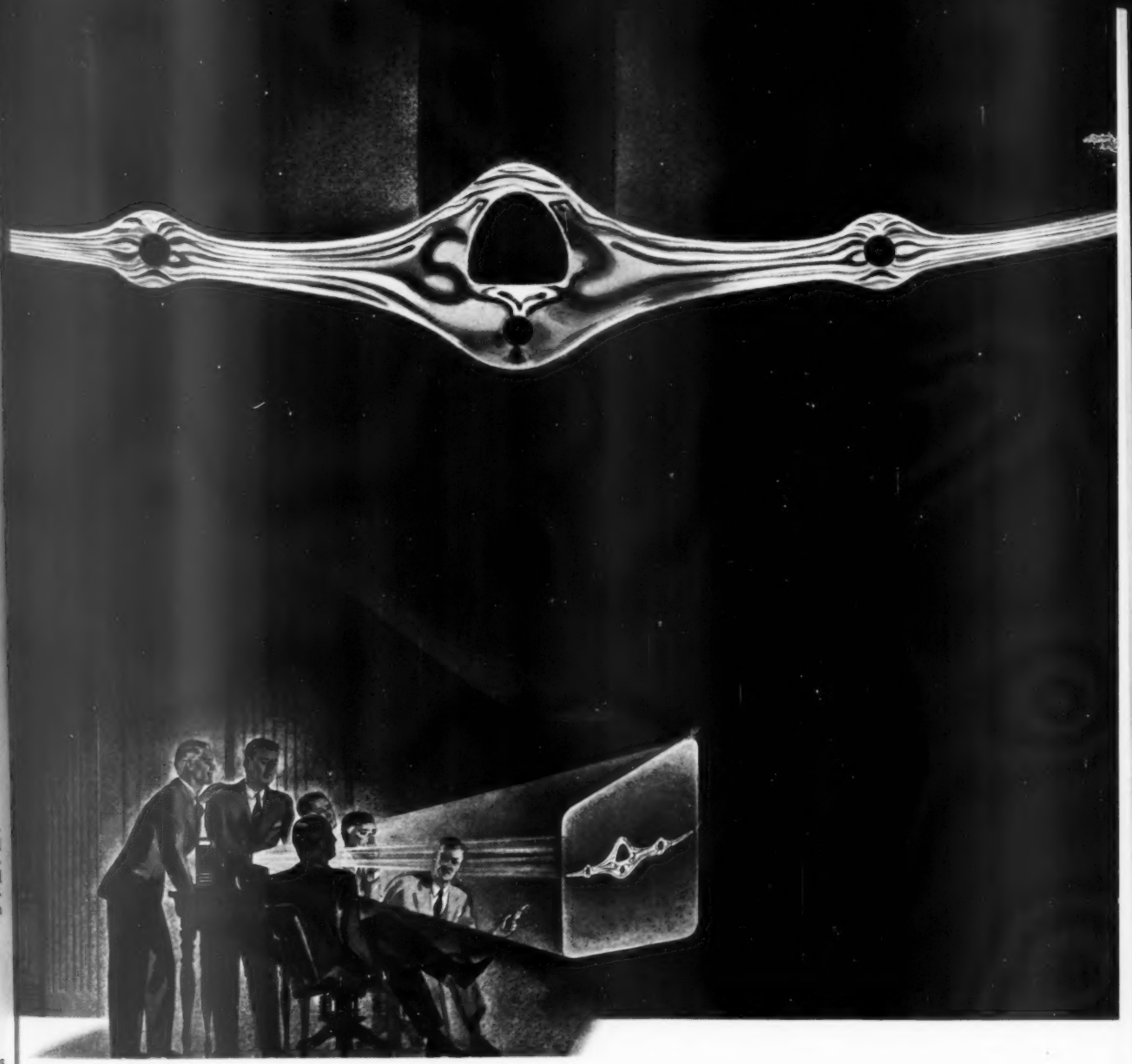
Executive Vice President
Menasco Mfg. Co.
Burbank, Calif.

Sirs:
"You . . . deserve to feel very proud of this edition for it certainly presents the first complete report of U.S. Naval
(*Continued on page* 123)

"An' what gets me is, if we ever get back, we also get a medal!"



Portrait of the Solution to a Mathematical Problem

As colorful and beautiful as a rainbow, this could be a portion of a butterfly's wing. Actually, it is a color picture of the stress patterns of an airplane spar, taken by means of a polariscope, under laboratory conditions which simulate the air loads encountered by an airplane in actual flight.

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And already, Franklin engines have been chosen to power several of these new, experimental planes, including the amazing Sikorsky helicopter. When the war is won, all the skill and experience gained in Franklin's 12 years of air-cooled power production will go into making new and ever finer engines worthy of the planes to come.

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Currently, Aircooled Motors Corporation's entire facilities are devoted to the design and production of Franklin warplane engines for military and naval use.

(*Continued from page* 120)

Aviation at War. . . . I was particularly impressed with the photographs which not only presented the subjects very clearly but are beautiful as well. A great deal of the material in this book will be of immeasurable value to us in some of the courses at this school. You are to be congratulated on the splendid job you have done in presenting this timely issue to the public."

H. M. BRIGGS
Captain, USN
Naval Training School
Dartmouth College
Hanover, N. H.

Sirs:

"I have received my copy of FLYING magazine, devoted to U. S. Naval Aviation at War and would like to add my hurrahs to the countless others you must be receiving on the excellence of your latest edition. It is by far one of the finest issues on aviation I can remember seeing, equalling or even surpassing your superlative issue of last year on the Naval aviation program."

H. C. BALLOU
Lieutenant, USNR
New York, N. Y.

Sirs:

". . . I am most certain that as soon as the present conflict is over, FLYING as a publication and flying as a sport and profession will experience the greatest growth that has ever been made by any enterprise or industry in this country. Flight schools' success immediately following World War I will be a drop in the bucket compared to the prosperity these institutions will enjoy following our present conflict. I am so convinced of this that as head of the United Flying Schools of America, as well as of this institution, we are making plans even now to anticipate this great era of civilian flying that lies immediately ahead."

RALPH HEMPHILL
President
Aero Industries Technical Institute
Los Angeles, Calif.

Sirs:

"You have done a splendid job in assembling the data and I was very much impressed by the photographs, especially those in color."

RANDALL JACOBS
Rear Admiral, USN
Washington, D. C.

Sirs:

"Your fine work in connection with the issue is indeed of genuine service to the country."

L. E. DENFELD
Rear Admiral, USN
Washington, D. C.

Sirs:

"You are to be congratulated for what is indeed a splendid piece of work. This particular issue of FLYING represents a valuable summary of factual information regarding the vital role of Naval aviation in this war. It pictures clearly the concrete achievements already attained, as well as the constant expansion and development that is in progress to maintain Naval aviation at the peak of wartime effectiveness in conjunction with all other arms. The contents of the book are receiving careful attention and study at the Naval Academy."

J. R. BEARDALL
Rear Admiral, USN
Superintendent, United States Naval Academy
Annapolis, Md.

Sirs:

"At the present time, the Materiel Center is doing a great deal of experimental work in color photography, and in this work we have a splendid opportunity to study the various processes and results being obtained in making color reproductions for publication purposes. In my opinion, the color reproductions of FLYING and POPULAR PHOTOGRAPHY are by far the best, and this includes the popular travel and fashion magazines."

GEORGE W. GODDARD
Colonel, USA
AAF Materiel Center
Wright Field
Dayton, O.

Sirs:

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and white photographs, to say nothing of the way the whole thing is laid out, makes your special issue a markedly effective production job."

THOMAS ORCHARD
Lieutenant, USN
Navy Yard
Portsmouth, N. H.

Sirs:

"I believe this special issue of FLYING is the only record of its kind. I know it is considered to be of great value to men undergoing training in aviation, as well as to the general public. I have always felt that the citizens of this country were too poorly informed concerning the many phases of Naval aviation. I wish to offer my congratulations to you . . . for this splendid service to the U. S. Navy and to our country and to extend my personal thanks for being invited to contribute a small part of it."

JOHN S. THACH
Lieutenant Commander, USN
Air Operational Training Command
U. S. Naval Air Station
Jacksonville, Fla.

Sirs:

"I have found your articles as well as your illustrations most educational and enjoyable, and feel that your lasting recordings of wartime activities produce a wealth of information to all those who are intensely interested in all phases of aviation."

W. J. CARTER
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Navy Department
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Sirs:

"The Ziff-Davis Publishing Company is to be commended upon the very excellent spirit of assistance and cooperation which they have rendered the Naval Aviation Cadet Selection Board in their efforts to furnish the superior type of individuals necessary to man the air corps and become the Naval flying officers of the calibre, which you so thoroughly understand, are necessary in our program."

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Lieutenant Commander, USNR
Officer in Charge
Naval Aviation Cadet Selection Board
New Orleans, La.

Sirs:

"You have done a great job. The volume is one which all who are interested in Naval aviation will value."

A. G. KIPKE
Lieutenant Commander, USNR
Detroit, Mich.

Sirs:

"We have found this volume to be of great value . . ."

ARMANDO REVOREDO
Colonel, Air Attache
Peruvian Embassy
Washington, D. C.

Sirs:

"I know that you will be interested to know that this same issue was sold out twice at our Ship's Service Store and is now on order again. As commanding officer of this station, I am aware of the kind of book that the officers enjoy reading and I can readily assure you that the issue of FLYING is an excellent example."

JOHN M. RUTHERFORD
Commander, USN
U. S. Naval Air Station
Hatboro, Pa.

Sirs:

"My congratulations for a swell job."

H. A. KENT
President
P. Lorillard Co.
New York, N. Y.

Sirs:

"It is a splendid publication and I am sure that it will be a very valuable contribution to this most important phase of our wartime activities. We are planning to use this publication in connection with our instruction in aviation."

G. N. BARKER
Captain, USN
Professor of Naval Science & Tactics
Harvard University
Cambridge, Mass.

Sirs:

"I have had time only to look it over casually, but even so can see that it contains a wealth of information on the war time activities of Naval aviation."

SHERMAN MILES
Major General, USA
Boston, Mass.

Sirs:

"I feel that this issue of FLYING is one of the most timely that has been published on Naval aviation, when U.S. Naval aviation is making such a creditable record in the theaters of operation. We have received many favorable comments, some of them quite laudatory, from our civilian friends who, heretofore, have known little of this service."

H. T. ORVILLE
Commander, USN
Bureau of Aeronautics
Washington, D. C.

Sirs:

". . . this will give me some very valuable material on Naval aeronautics. I have tried to find another copy, but the newsstands do not seem to have it, or at least the ones that I have seen . . . I should be grateful if you could send me another copy. You are to be commended for doing such a fine job, which I trust you will be able to continue."

FRED A. HARTLEY, JR.
Congressman from New Jersey
Washington, D. C.

Sirs:

"As usual, you did a highly competent job. I remember the excellent work last year that received so much comment in the wardrooms of our men-of-war."

LELAND P. LOVETTE
Captain, USN
Director of Public Relations
Washington, D. C.

Sirs:

"You are to be complimented on the fine appearance of this publication and I find it most interesting."

E. V. ROBERTSON
Senator from Wyoming
Washington, D. C.

Sirs:

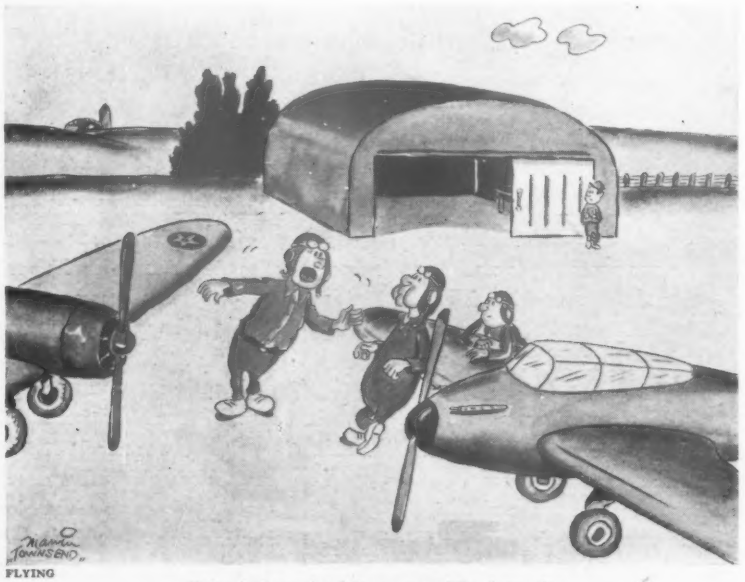
"It is, in my opinion, an exceptionally valuable book, covering the present status of the Naval air arm more comprehensively and authoritatively than anything of its kind I have seen. Both textually and pictorially, it is a superb job. It not only affords very interesting reading, but also makes a most useful addition to my library as a record of what has been accomplished in the Navy's air arm."

C. H. WOODWARD
Rear Admiral, USN (Ret.)
Washington, D. C.

Sirs:

"The February FLYING issue is about the finest I have seen depicting Naval

(*Continued on page* 148)



"I banked to the left, swooped in from the side, and what'ta you think? She ignored me!"

GREATER NAVY STRIKING POWER
FOR THE SEVEN SEAS FLEET
Increased range and fire power was the logical result when the U. S. Navy pioneered development of dive bombers which now pace our winning fight on the seven seas.
Through the power of Brewster Blasters and other Navy dive bombers the Axis will learn the bitter folly of attempting unwarranted aggression against strong nations united by a determination to remain forever free.
BREWSTER Blasters
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We're flying higher—faster—farther

America's rising air superiority is mainly due to excellent pilot training, engineering skill and overwhelming production. But another part of the story of our air power is a story of the finest aviation fuels and lubricants in the world.

The petroleum industry is making lubricants that withstand the terrific heat of 2,000 horsepower engines, yet flow freely in the intense cold of the stratosphere. Rugged engine oils permit huge bombers and cargo planes to fly across an ocean and back without an overhaul. Fantastically improved high-octane gasoline helps give our fighter planes speed and maneuverability that the enemy can't match.

We can only hint at the qualities of these new products now — but when the war ends, they will become available for private and commercial planes and automobiles. Then they will help usher in a new era of better, more economical transportation, bringing benefits to every part of our society. And that's a promise.

Quality-Service STANDARD STANDARD

STANDARD OF CALIFORNIA

Why Stalls and Spins?

(*Continued from page 54*)

The second kind of stall is just like the first one, except that after reaching the burble point no attempt is made to recover. Instead, the stick is eased back until it reaches the stop, indicating that a full stall has occurred. It is exactly like a landing and is a good way to teach landings to beginners.

All the while the stall is going on, use those four senses. Memorize the appearance of the nose and wings, listen to the sound of the air, feel the stick with the *tips* of the fingers, *never* the clenched fist and finally relax the intestines and cultivate the use of those deep-seated or kinaesthetic muscles.

When the stick is all the way back, push the stick promptly but smoothly forward. *Don't just sit there!* The nose will drop of its own accord, but some day, if you persist in using a lazy recovery, you may drop 75 feet from an altitude of 74, whereas prompter action would have effected a recovery within a more convenient limit.

Practice these two types of stall at least once a month, or if you're a weekend pilot, every time you fly. Very soon you'll be so good at judging speed that you can calibrate your airspeed indicator by the feeling of the plane in a stall! And it goes without saying that you'll never be featured in a CAA report.

Last, there is the question of the spin. Why practice spins? One reason is to develop a technique in recovering from them. Spins, in themselves, are rather pointless; of doubtful military value and merely an example of what not to do, the spin is useful because we learn a recovery method only by spinning. Precision spins merely indicate that the technique has reached a high stage of perfection—nothing more.

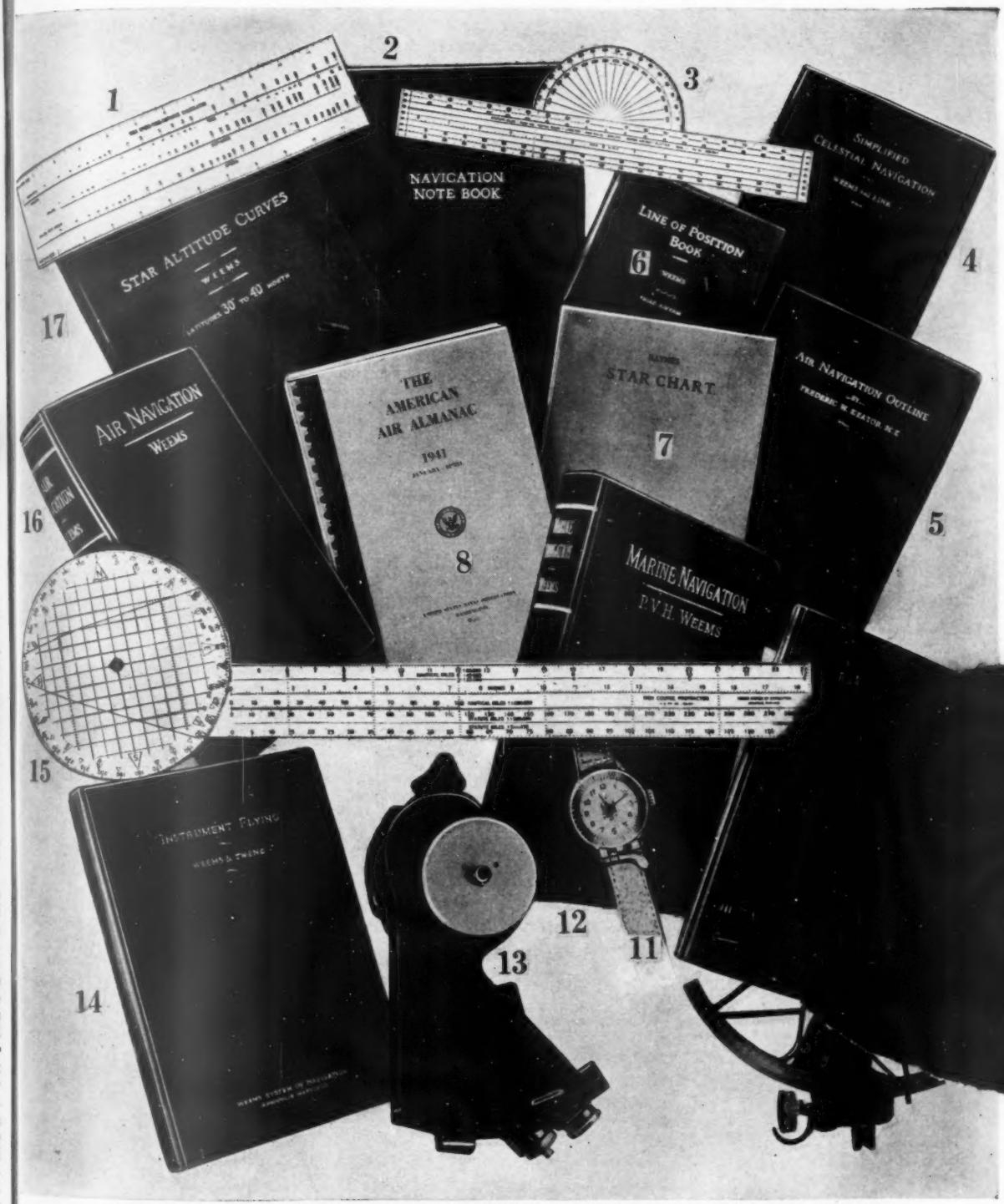
The technique of recovery varies so much from plane to plane that it will not be given here. Briefly, a smooth NACA recovery (opposite rudder, followed by neutral stick) is desirable, followed by an easy pull-out in which the airspeed is less than 50 per cent above normal cruising. Too much airspeed is hard on the wings, while too little speed might cause a second stall.

The point is this: if sufficient training in stalls is given a pilot, he will never spin involuntarily. Stated more accurately, and granting that modern planes won't spin unless they are held in the spin, continued practice in stalls and stall recovery will prevent pilots from entering an incipient spin, from which recovery is impossible due to close proximity with the ground.

END

Shadle CAA Counsel

WEBB SHADLE, World War I flyer and formerly counsel to the director of finance for the state of California, has been appointed general counsel of the Civil Aeronautics Administration.



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Write to: Weems System of Navigation, Annapolis, Maryland

Air Services Section

...vation is this tarpaulin to protect ... of sun and rain.

Seven men are accommodated in this new life boat. Less tippable and more seaworthy, craft contains many improvements such as large square-rigged sail for navigating.

...IFE BOAT FOR AIRMEN

...ces and ...xperi- ...Ed- ...and ...as ...the ...mall ...afts, ...n the ...ecom- ...other ...lowned at ...iated in the ...of a new, fully ...designed to lessen ...American airmen under ...circumstances as they await ...escue.

Planned to accommodate seven men, the boat is 12 feet long, 5 ft. 8 in. wide, and folds into a case 3 ft. x 1½ feet. As the boat inflates, the carrying case becomes a sea anchor to keep the boat from drifting away. The sea anchor can then be used to keep the nose of the boat headed into the wind and reduce the possibility of tipping in heavy seas.

Among other noteworthy improvements is a large square-rigged sail, enabling the occupants to navigate with winds. When completely fitted, the boat includes a fishing kit, signal kit, tarpaulin, first aid equipment, concentrated rations for a period of 30 days, water and —in some cases—a radio sending set.

Taking a tip from survivors of planes crashed at sea, essential equipment such as the sea anchor, bailing bucket, plastic hand pump, etc., will be tied by cord lines to the boat so they cannot be lost during the excitement of transferring from a sinking plane. Other equipment such as a knife, repair kit, whistle, etc., will be stored in pockets with zipper fasteners.

The new boat, designed by the Army Air Forces' Wright Field and United States Rubber Company experts, now is in production at a New England plant of U. S. Rubber Co.

Experience of Capt. Eddie Rickenbacker and others led to design of this life boat and its equipment. Fishing kit is included to help augment 30-day ration supplies.

Cooperation

Successful modern warfare demands the utmost cooperation in effort from both fighting forces and civilians. The men and women of Breeze are doing their part — buying War Bonds and working day and night to turn out Breeze equipment for our battle units on land, sea, and in the air. Such products as Breeze Ignition Shielding, Flexible Conduit, Fittings and Multiple Electrical Connectors for communications systems on aircraft, ships and tanks, make possible dependable communication by radio, and help in no small measure to coordinate America's hard-hitting drive to ultimate Victory.

BREEZE MARK

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VOICE OF THE BOMBER

EVERY four-motored bomber that roars away on its mission in the far-flung theaters of this war will have in its crew two radio operators. Every flying field on four continents, whether in the bleak and ice-bound north or on some fronded tropic isle, has two radio operators. Every coastal airport in this country, bound in the network of air defense, has its complement of radio operators.

These men are the ears and voice of the Army Air Forces, soon to become the greatest armada of flying ships ever organized by one nation. They are needed to start the planes on their way, to guide them on their journeys, and to land them safely at their home base.

Without these skilled operators and their brother mechanics and trouble shooters, the Air Forces is grounded. It is essential that there be a steady output of radio operator-mechanics to maintain aloft the steady stream of planes now flowing off the factory assembly lines.

The task of the Army Air Forces Technical Training Command is to supply these vitally needed radio operator-mechanics. To this end, the Technical Training Command operates five radio schools which are producing thousands of radiomen. Scott Field, Ill., a base for training flyers in World War I, is the parent radio school of the TTC. Others are located at Madison, Wis., Sioux Falls, S. D., and Chicago.

The importance of the radio operator cannot be over-emphasized. It is the radio operator who keeps in contact with the home base and receives orders, instructions and weather data. In actual combat, when radio apparatus must be silenced to prevent giving information to the enemy, the radio operator has other duties to perform. He is something of a "man of all work," with his own gun to man when Jap and Nazi fighter-planes attack or he might be called upon to replace some other gunner who has become a casualty. As in an old axiom:

"In fights he runs from gun to gun,
The RO's work is never done."

How is a radioman trained for actual combat? First, a radio student is selected on the basis of his rating in the Army aptitude test conducted at reception and basic training centers. To get into the Air Forces radio communications, the soldier must make a high grade. Other students come direct from tactical organizations.

AAF Technical Training Command

Student technicians install the antenna and check radio system of Douglas B-18.

After being assigned to one of the Technical Training Command radio schools, an embryo operator studies six days a week, seven hours a day. The student's first courses are radio operating and mechanics. These courses run parallel so that when a student has completed his 18 weeks of schooling he is graduated as a radio operator-mechanic.

The first subject the student covers in radio mechanics is a 70 hour course in direct and alternating current theory. The next 70 hours covers the theory of antennas, vacuum tubes and the construction of radio transmitters. The student finishes his fundamental training with a 35-hour course in radio receivers. When the student finishes this course he has an understanding of the principles of radio reception, detection, radio frequency and audio amplifiers, and elementary theory of the operation of tuned radio frequency and superheterodyne receivers.

Upon successful completion of the fundamental course the student moves to the aircraft radio division of the school. There the student studies the actual radio transmitters and receivers. He spends a total of 175 hours on the operation, tuning, trouble shooting, maintenance and inspection of aircraft transmitters, receivers and radio compasses. This phase of the training usually is climaxed with 10 days operation of ground stations.

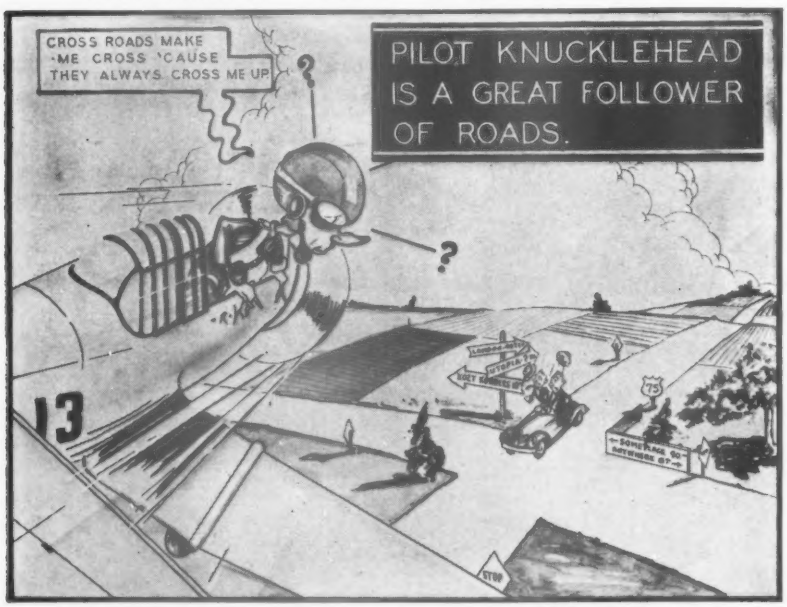
Three and one-half hours of the student's day is spent in radio mechanics' study. The remaining three and one-half hours he is enrolled in the radio operating division where he is introduced to the International Morse code. Half of the entire total of 558 hours of study is spent on the International Morse code, which has twice the penetrating power of human speech.

For the mastery of the code requires the learning of a foreign language in a very special sense. While all spoken languages, be they English, Greek or Chinese, are phonetic, made up of sounds produced by the human tongue, lips and teeth, the Morse code language requires an entirely different approach, the sounds being produced by a mechanical device with dots and dashes being the symbols of letters.

For this particular reason previous formal education has little relation to progress in mastering the Morse code. All start from scratch and inherent aptitude is largely the factor of success.

Upon graduation, many radio operators are sent to gunnery schools where they learn how to operate .30 and .50 caliber machine guns. After a short course they are sent to the operational training centers to be welded into bomber crews—to become part of a team that will eventually see service overseas. Some of them, transcending their routine training, become modern warriors of the clouds because, sooner or later, every radioman has to drop his earphones and grab a machine gun instead.

THE AAF'S "CADET KNUCKLEHEAD"



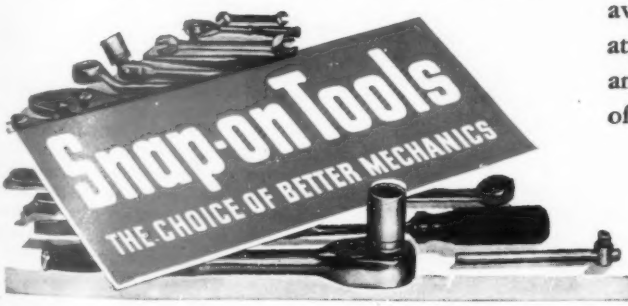
No. 4 in the series of specially prepared drawings used by the Army Air Forces to impress upon aviation cadets the "wrong" way of conducting themselves in air.

Tools that meet the need for *SPEED!*

In no other industry does *tool efficiency* count so heavily as in aviation. On countless thousands of operations in production, assembly and maintenance the *right* tools . . . *the fastest tools* . . . permit and encourage higher output and greater precision from every worker.

Snap-on tools squarely meet aviation's need for speed . . . *and more speed.* They help turn out more work and *better work.* They are used and endorsed by every major airline in America. In famed engine and parts plants . . . along the industry's greatest production lines . . . at maintenance and overhaul bases everywhere . . . their flexibility and swift application, solid grip and powerful leverage, are saving priceless seconds, minutes, hours!

The 3,000 tools in the Snap-on line, and Snap-on's direct-to-you service, are conveniently available through 35 factory branches located at key air centers throughout the United States and Canada. Write for catalog and address of the nearest branch.



SNAP-ON TOOLS CORPORATION

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HE'S A TRAINED MAN!

★ The importance of *sound training* is dramatically illustrated by America's fighting airmen.

But trained men in uniform can't win this war *alone*. They must be backed up by trained men on the industrial front — trained men to keep 'em *flying*, keep 'em *rolling*, keep 'em *sailing!*

Now's the time for *you* to get the training that will make you a better fighter on the battlefield of production! For a few dollars a month, you can study an I. C. S. Course in your line of work, and acquire sound, practical *training-for-success.* Mail this coupon for complete information, without obligation. Mail it *today!* Right now!

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Explain fully about your course marked X:

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Canadian residents send coupon to the International Correspondence Schools Canadian, Limited, Montreal, Canada. British residents send coupon to I. C. S., 71 Kingsway, London, W. C. 2, England.

AIR FORCES' PORTABLE SHELTER

Personnel of the Army Air Forces stationed in cold regions are being provided this new type of portable shelter. Blankets of glass fiber insulation cut heating costs.

IN line with its efforts to conserve critical materials and reduce demands upon shipping space, the Army Air Forces have awarded to the James Manufacturing Company, Fort Atkinson, Wis., a contract for an undisclosed number of a new type of lightweight, portable shelters for use by Air Forces personnel in Arctic climates.

The shelters are specifically designed to save weight, to occupy a minimum amount of space when packed for shipment and to reduce the amount of fuel which must be shipped to heat them, by incorporating blankets of glass fiber insulation in the walls and flooring. When packed for shipment, they are sufficiently light and compact to permit transportation of the complete unit by air.

Of impregnated cotton fabric and laminated wood frame construction, the shelters, when erected, are 16 feet in width by eight and a half feet high in the center. They may be used in any eight-feet multiple of length. They will be warmed by gasoline heaters.

While the Fiberglas insulation weighs only about 200 pounds for a 16 ft. by 16 ft. shelter, it is estimated that it will reduce from 27,360 pounds to 6,790 pounds the weight of the fuel that must be transported to maintain in each shelter, throughout the heating season, a temperature in which men can live comfortably.

The total weight of each such shelter is approximately 1,200 pounds.

Hero Gets Medal

T/SGT. RONALD W. BARKSDALE, assigned to Eglin Field, Fla., was recently presented the Soldier's Medal for Valor by Brig. Gen. Grandison Gardner following an impressive review of the troops of the station. According to the citation, Barksdale saved two adults and two children from being burned and crushed when the blazing roof of their house caved in.

Barksdale ran into the house and carried the four to safety a few seconds before the roof caved in. He then gave the family $10 for food before driving on and thought no more of the incident until told by his commanding officer that he was to be awarded the medal.

The B-B Shot Boys

LIEUT. COL. GERMAN P. CULVER while stationed at the Moore Field, Tex., Advanced Flying School, concocted a B-B shot machine gun for the training of aerial gunners and pilots. Combining the good points of Junior's electric train and air rifle, a Link trainer and a large room, the colonel set up his shot and shell saving gadget.

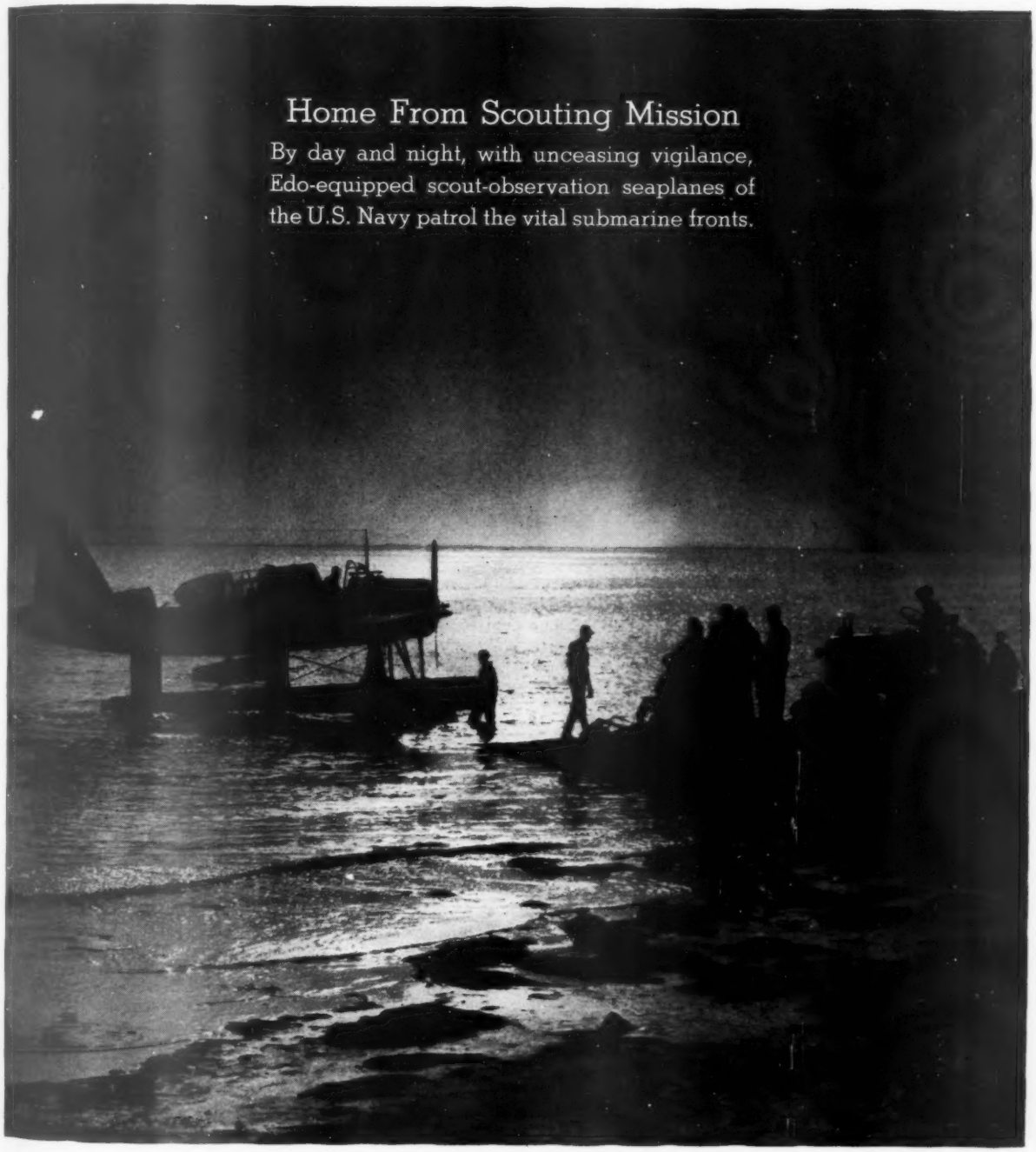
The B-B machine guns using 80 pounds of air for a charge are mounted on the trainers at one end of the room while at the other the small electric train hauls small paper targets on a twisting track. When ammunition runs low, the gunnery students run a vacuum cleaner over the target area and collect the shot for later use.

Flight Strips

MORE than 20 flight strips have been completed or are under construction. The strips have already proved their value. One of the first built—on the southeast coast—saved an Army bomber. Hemmed in by bad weather, the bomber was set down on the landing pavement, saving pilot, crew and ship.

EDO FLOAT GEAR

SERVES THE UNITED NATIONS



Home From Scouting Mission

By day and night, with unceasing vigilance, Edo-equipped scout-observation seaplanes of the U.S. Navy patrol the vital submarine fronts.

★ ★ ★ ★ ★ EDO manufactures single and twin Float Gear for the aircraft of the U. S. Navy, U. S. Army Air Forces and leading Foreign Governments.

Edo Aircraft Corporation, 414 Second St., College Point, N.Y., U.S.A.

Sergeant Skinner and the portable radio control unit he built for auxiliary use.

Yankee Ingenuity

T/SGT. JOHN T. SKINNER, stationed at the Army flying school, Waco, Tex., was getting a little tired of installing new batteries in airplanes which had been used as control towers at auxiliary flying fields.

The ships would be flown from the Waco port to the field and their radios would direct the cadets in and out as landings and take-offs were practiced. John (or one of his radio crew mates) often would have to drive a jeep out to the field and install a new battery in the control plane as the radio's usage would put the storage units in such shape as to place the plane out of commission.

John began thinking and, relying on both Army training and his pre-war radio "ham" background, concocted a portable control tower mounted on a dolly instead of a landing gear. Carrying all the necessary equipment for radio communication, the Skinner-designed unit packs its own juice in two storage batteries. It can be carried to the auxiliary field on a jeep and can be set up in operating form within a few minutes by one man.

The component parts of Signal Corps radio set SCR-AL-183 are used, and for radio servicing adaptability, the radio filters FL-5-C and an interphone amplifier Type BC-212-C are employed. This radio servicing adaptability makes the set a simple way of locating trouble in aircraft radios.

Plastic Glider

THE new Bowlus glider, now being manufactured for the training of Army glider pilots, is the first all plywood-plastic ship of this type, the manufacturers report. They also state that since the craft has almost no metal, it is nonmagnetic and therefore will be practically free from detection by magnetic devices.

The initially tested glider is described as a two-place "transitional" trainer embodying the latest design development.

"Pensacola Reports—"

TWO more auxiliary base fields, Corry and Ellyson, have been commissioned auxiliary air stations at the Naval Air Training Center, Pensacola, Fla., under the command of Rear Adm. George D. Murray, commandant. Only one, Saufley Field, remains to be commissioned to complete the transition begun last November with the commissioning of Bronson Field, followed in December by the addition of Barin Field, which was brought directly into the NATC as an auxiliary air station.

Corry Field, which was established in 1934, is the oldest of the outlying fields at "The Annapolis of the Air." Ellyson Field was added in October, 1941.

The Naval School of Photography, the only one of its kind in the Navy and supplemented only by a technical laboratory at the Naval Air Station, Anacostia, D. C., was expanded by 50 per cent of its capacity when an annex was opened adjacent to Building 18, which is turning out an increasing number of photographers.

The new annex will provide an additional 7,200 square feet of floor space for class rooms and offices.

Recently invented and installed in the school is a new device which is cutting hours off the time required for students to learn aerial mapping technique. Originated by members of the school's faculty and constructed by craftsmen employed by the Public Works Department, the machine is designed to give synthetic aerial practice.

Students are required to take four-hour checks in the device before entering the air for actual aerial photographic work. Before taking up flying time, they learn to direct the "crabbing" of a plane to follow flight lines and to accomplish the necessary co-operation between pilot and cameraman.

Ground school classes in celestial navigation, organized several months ago for the voluntary attendance of NATC personnel who anticipate the need of such training, are now scheduled to be held six days a week instead of three.

These classes, which supplement the regular NATC program, enable personnel to gain a technical knowledge of celestial navigation, the plotting board and searching technique, although they may not be directly concerned with them in their present duties.

The revised schedule went into effect February 1 and new classes will be started each month.

During the six months ending December 31, the Naval Air Training Center eclipsed all its own previous records for the number of hours flown. While the exact number of hours is a military secret, it may be said that it exceeded the number of hours for the first six months of 1942 by 16.8 per cent and the number of hours of flying time for the corresponding period of 1941 by 34.2 per cent.

Strictly G-I

IT was Friday morning and the men were all lined up before their Enid Army Flying School, Okla., barracks for the regular morning roll call. The barracks chief said, "Boys, you are all invited to a party tonight so don't make any other plans as my feelings will be hurt terribly if any of you don't attend."

There was a party all right, a GI party. The bucket brigade with their trousers rolled to their knees, furnished the chorus line. An interpretive dance was done by one of the window washers who stepped down from a window onto a bar of soap lying in a puddle of water. He stole the show. A "slide of death" was done by a late comer who came rushing in with excuses ready as to why he was late. He hit the soapy wooden floor about 10 feet from the front door and caught up on his share of the mopping before stopping against the back wall.

The show was done to the tune of "Are we going to do this every Friday night?" The barracks chief was the master of ceremonies. He made quite an impression on his audience. In fact he had them rolling in the aisle. Everyone enjoyed the good clean fun. The critics believe that the show will have a long run.

So I Said, "Colonel..."

LIKE a page of Horatio Alger, S/Sgt. Antonio G. Jimenez met a colonel one day and a week later was giving the same colonel lessons in Spanish. A language major in college before entering the Air Forces and being stationed at Ellington Field, Tex., Jimenez answered the officer in Spanish. On the spot he was queried as to his training in the language. Subsequently, he was transferred to the field school where he now is chief of the educational system.

Gable's New Role

Lieutenant Gable won his aerial gunner's wings through training in ground "turret."

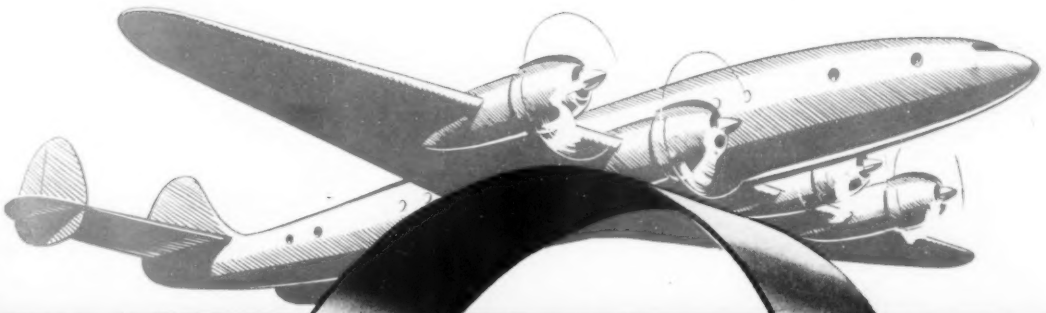
IT'S a tight fit for such a big-boned man as Lieut. Clark Gable to get inside one of these moving turrets mounted atop a truck for range practice—but he's in and banging away at his target with a .50 caliber machine gun on one of the many ranges at Tyndall Field.

The former movie actor, who entered the Army Air Forces as a private last August, was graduated recently as an aerial gunner from Tyndall Field and thus won the right to wear the chest silver wings of an aerial gunner.

CLAMPS
that fly with the CONSTELLATION

When exhaustive tests proved that MARMAN CLAMPS provided maximum performance with minimum weight they were adopted for the Wright engines that power Lockheed's new "Constellation."

Meanwhile, MARMAN CLAMPS are convincingly demonstrating their versatility and efficiency on many other American war planes. Aircraft engineers, as well as those in general industry, are now solving their most troublesome clamp problems with the sturdy, reliable MARMAN CLAMP. Write today for information . . . Our experience is at your service for standard and special MARMAN CLAMPS. We are prepared to make prompt deliveries.



Maintenance Inspections

by ROBERT J. CURRY

Proper maintenance demands more than a casual pre-flight check. Mechanics should take a half hour for the job.

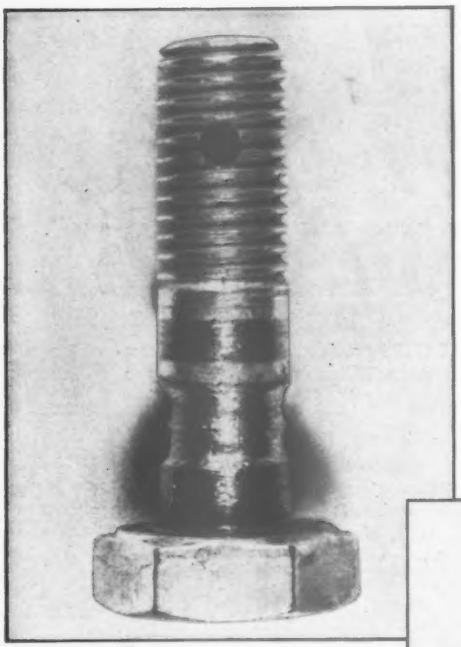


Figure 1. Taken from an aerobatics trainer, bolt would not have lasted 100 hours.

Figure 2. Having removed this cable's bolts, inspector found wires broken.

DURING the last year, maintenance of aircraft has been one of the major problems of all operators. Old maintenance standards no longer are adequate to keep ships in the perfect condition necessary for strenuous use such as they now are getting.

Some operators have good maintenance and others are continually having trouble. All operators are trying hard to maintain a high standard. They are all hiring the best men available and are using what they consider adequate facilities, but for some reason their maintenance does not improve in proportion to cost.

Successful maintenance is a combination of good personnel, good facilities and proper management. No one can do without the other. Good maintenance depends on the use of methods adapted by others when these have been found to be successful.

WTS (formerly CPTP) maintenance has recommended the use of the following forms in developing successful maintenance: The daily inspection form ACA-526, the periodic aircraft inspection form 319 and the aircraft maintenance record ACA-529. Of course, the use of an inspection form is not in itself going to solve any maintenance problems, but the intelligent use of these forms, with a clear understanding of them, will go a long ways towards developing the sort of maintenance every operator hopes to have in his shops.

First, let's take Form 526. This is a daily inspection form required before each day's flight. The inspection is made by a mechanic, or by a student under the supervision of a mechanic. It is divided into seven major headings: propeller, engine, landing gear, wings, tail control surfaces, fuselage and warming up. Each of these major headings is subdivided into the individual parts of that particular group. A complete inspection of the plane, going over all of the parts listed and checking them thoroughly, will take a good half hour's time for an experienced line man, but mechanics and operators are doing it in 10 to 15 minutes, thinking that they are covering the inspection adequately.

Under the major heading of propellers: 1. *Inspect the propeller blades for pits, cracks, nicks.* In our repair station we follow this procedure in checking a wood propeller under this item. First, the propeller is checked to see that it is clean. Second, the tipping is checked to see that it is tight. In checking the tipping see that it is tight to the wood at the edges and that the screws are all in and not loose in the solder. See that the leading edge is soldered tight and that rocks and weeds have not dented and nicked it to the point where the metal has weakened. Next, starting at the tip go over the wood of the blade and check for cracks. Remember that a crack can be very small and may take painstaking examination to find, so extreme care must be used in this part of the check. Check in particular the point along the trailing edge where the propeller is grasped during cranking. This part is thinnest and is often subjected to severe abuse. Check the wood near the tipping for cracks originating from the screws and rivet holes. A point in any laminated surface is the glue joint. Check the glue joint in each lamination for separation and cracking. Look around the hub plate carefully for cracks originating from the bolt holes. Check the hub and the wood around the hub for red dust. This is covered in I'em 2 under *hubs* but can be checked at this time as well. This red dust is an indication of play between the propeller and the hub or between the hub and the crankshaft. It is important that either one of these conditions be cleared up at once if the propeller is to be kept in good condition.

The point to be made is that the mechanics are spending enough time, but are not giving enough thought to the inspections and covering the important items with the thoroughness that they should.

A short time ago an accident occurred when the landing gear failed on a ship in landing because a bolt dropped out of the gear. This particular model of ship has a habit of breaking bolts regularly. The mechanics checked the ship carefully at each line inspection, but they did not test the bolt by turning it slightly with a wrench to see if both ends turned. A small item, perhaps, but it could have been done properly, saving a repair bill and preventing the equipment tie-up.

Each operator will find that he will improve his maintenance and cut down on wasted time if he will have regular meetings with his mechanics and go over the problems of each inspection form, discuss each point and get a definite method of inspection for that part. Follow this method and do it every day until someone originates a better plan. Above all, follow the form in detail and do a good job. Those operators who have done this

(*Continued on page* 128)

'Til Victory is Won —

WE'VE GOT A JOB TO DO, TOO

United States Naval Airmen are daily on the job helping to stamp out forever the flame of hate and destruction that has swept the world. These men and their planes are writing new chapters in daring, courage, skill and brilliant achievement that will be conspicuous in the history of this war.

They are the finest Naval fliers in the world, and that recognition is a tribute to the training program of U. S. Naval aviation. The Lewis School of Aeronautics is now a part of this expanded program. Until Victory is won, therefore, our facilities, personnel and equipment will be devoted to the Navy, training AVT commissioned officers. After that has been achieved we will again be training youth in flight, master mechanics and aeronautical engineering.

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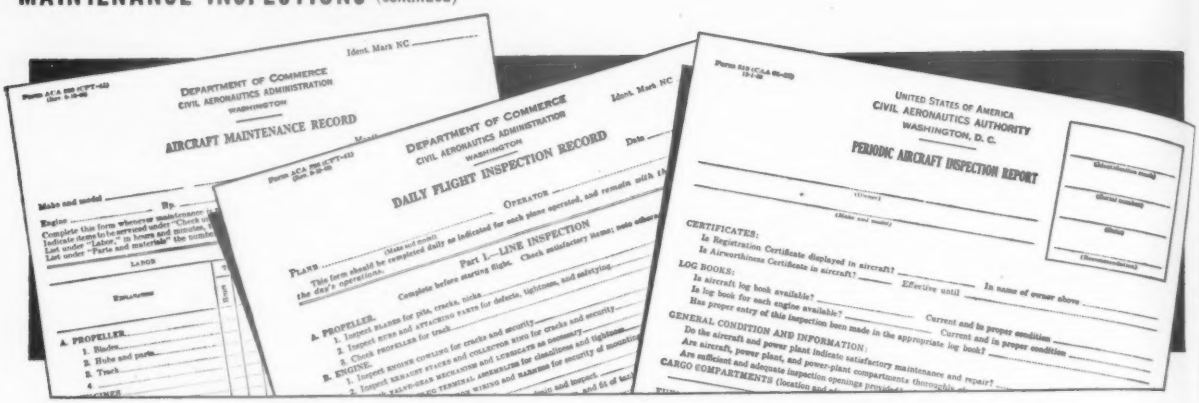
MAINTENANCE INSPECTIONS (continued)



The CAA requires that the flight operator fill out and file these inspection charts.

find that it has paid well in the end.

Form 319 is familiar to every mechanic and operator, but the detail that is involved in the inspection is not clear and is a point of debate between mechanics. In the past the form has been gone over in a couple of hours, signed and the ship approved. However, lately it has been found that, as in the Form 526, the items need thought and a definite procedure established as to what to look for and where to look.

This form lists the items of a good inspection but does not go into the details because of the number of different types of ships the form is being used on.

I think that the first item to bring out on an inspection of this type is to be sure and take nothing for granted. Check it yourself, as you are the one to certify that it is in good condition. The second thing is to be willing to use the space left for "remarks" to list defects found and to list parts that are weak and apt to give trouble in the future. Use this space (and another sheet, if necessary) to tell what you did about the defects. Did you fix them or did you just want to call them to the attention of the owner and the next mechanic who makes the inspections so that they could be fixed before they gave trouble?

In this form, as in 526, it is important that the mechanic decide the best method of conducting the inspection, after he first makes sure that he understands just what he is looking for and where to look. When this form is signed and made a part of the ship's log, it should be a complete report of its condition with remarks as to work done and work that will be needed in the future.

Form ACA-529 is a record of the cost of maintaining a plane and listing the labor and materials used. This form should be used in conjunction with 526 and 319 to show an accurate cost of the parts and labor used in the inspection as well as in any repair made to the ship.

Paper work has long been the bugaboo of mechanics, but paper work of the type used in the above forms actually makes the mechanic's work lighter. It saves hours of writing in logs and making out reports and is a neat and accurate record readily available for future reference.

A good business man is interested in any results that will save him money or improve the efficiency of his organization. Daily line inspections can save money by eliminating accidents such as the one caused by the failure of a bolt (that should have been discovered during the inspection).

On elementary type planes, namely, those under 100 h.p., a 100-hour inspection checking the complete ship and making all repairs recommended by the inspecting mechanic will keep the ship in safe condition for all normal use; but on secondary type ships and advanced type ships a 100-hour inspection is not enough. Bolts that normally are good for a couple of hundred hours often have been found to have failed to the point of being dangerous in 50 to 75 hours. Control cables have been found to be fractured on the inside long before the time wear began to show due to normal pulley wear. Figure 1 shows a bolt that had 60 hours on the rudder horn of a secondary trainer used in aerobatics. It is doubtful if this bolt would have lasted for 100 hours before failure. Its condition was discovered during a line inspection. It is important to examine the cable terminals to see if the bolt or fitting is wearing, especially at the rudder and ailerons. It is important that each cable bolt be removed at each 50 and 100-hour inspection and checked for wear.

Figure 2 shows a part of a rudder cable that was found to have most of the strands frayed inside the cable. This condition can only be uncovered by removing the bolts at the cable ends and bending the cable at the point where the splice ends. Care must be used in this inspection so that the cable will not be damaged and it must be carefully checked to see that the ends of the splice itself are not being mistaken for frayed strands.

It has become a "must" in all overhaul routines to magnaflux all steel parts of the engine. Magnaflux no longer is a luxury or an experiment but has proved its worth by discovering hidden defects that are on the point of failure. A magnaflux inspection is no guarantee that parts are in new condition and are not going to fail, but it will reveal parts that have already failed or are on the point of failure. The ease of mind and the results obtained from this inspection are going to warrant the small extra cost involved.

With factories producing planes faster than ever before and using additional facilities for the manufacture of military sub-assemblies, there has arisen a definite shortage of trained men. Factory inspection has reached a new peak of efficiency but, as in any production, there are still slips, and occasionally one might get out that is defective or improperly rigged.

In order to overcome the possibility that your plane may have one of these overlooked points and in order to tighten up the play caused by settling of new parts into place, it now is considered good maintenance practice to run a 100-hour inspection on all new planes as soon as they are brought home and before they are put into service. This practice has proven its value many times in permitting the mechanic to catch loose nuts and bolts that were not cotter-keyed and also letting him tighten up drag wires and control cables that had stretched to a point where they were loose and dangerous. Wear has been prevented and failure stopped, controls and pulleys oiled, and the entire operation and life of the plane improved by an inspection at once before use on a program.

There is nothing in the above outlined inspections that will tax the facilities of the operator any more than in the past. The mechanics are going to find that they can do a good job with no more work and the results will cut down on their work at a later date. The pilots will have ships that are in good condition all of the time. They will have a part in keeping it in good condition and will cooperate with the mechanics. The student is going to have properly rigged ships to fly. The instruments in both cockpits are going to be working and he will benefit by the results. The manufacturer will know that he is going to have his product double-checked.

The operators' part in wartime is to train pilots and do it on the equipment that he has without drawing from materials and men needed to produce for the Air Forces. Inspections will help and it is up to him to train his mechanics to work with him as well as for him.

END

"We could always depend on the Learadio Compass to show us the way home"...

says A. F. (DUKE) KRANTZ

for many years Chief Pilot, New York Daily News Photographic Department.

★ ★ ★

"I have specified Learadio equipment for my planes for the last ten years, because in such flights as we made searching for Dick Merrill and Harry Richman, Trans-Atlantic flyers, whom we found in Newfoundland, and in our flight 250 miles out to sea to find the 'City of Flint', the Learadio Direction Finder Compass was invaluable in bringing us back direct to our base when gas was getting low and at night. We could always depend on the Learadio Compass to show us the way home, the shortest route."

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AIRCRAFT OWNERS AND PILOTS ASSOCIATION

AOPA NEWS

The Aircraft Owners and Pilots Association, with Service Headquarters in the Michigan Square Building, Chicago, Ill., is a non-profit organization formed and composed of non-scheduled aircraft pilots and/or owners exclusively. The AOPA operates with a full-time professional staff and is the largest group of civilian pilots in the world. The views and statements of opinion contained in this column are those of the Arcraft Owners and Pilots Association and not necessarily those of FLYING. This column is edited by the staff of AOPA for its members and other interested parties. Special releases of a more confidential nature are additionally sent each month to all registered members.

LAST month we made certain predictions in the AOPA Section, and also in the AOPA News, regarding the CAA War Training Service program. Our predictions were about 90 per cent correct, including those concerning Government purchase of private airplanes to perpetuate the WTS program.

In accordance with freshly signed contracts between the War Training Service and the Army and the War Training Service and the Navy, which call for the training of pilot groups in numbers hitherto unknown, the WPB issued a freezing order which stunned many private pilots. Its effect was virtually to ground a large portion of pleasure flying and to paralyze the miscellaneous fixed-base operations exclusive of WTS programs.

Can't Buy or Sell

Under WPB order L-262 both new and old aircraft (single-engined of 500 h.p. or less) cannot be sold except to the Defense Plant Corporation which will, in turn, make the ships available by lease, or other method, to WTS operators who will train students in groups beginning at 100 and in some cases going as high as 1,000.

How many ships are required is not known at the date of this writing, but it is expected that by the time this column is received the figures will have been made public. Pilots may gauge from the number of students to be trained, the number of airplanes to be purchased, as well as the probable length of time the WPB freeze will remain effective.

Purchases will be negotiated by the CAA within the respective CAA regions. For details AOPA pilots should write to the AOPA Washington Service Office where the necessary forms may be procured and assistance given.

As the rules now stand (subject to change), owners of airplanes are not placed under any flying restrictions. Those pilots who hire ships on an hourly basis, however, to keep up their flying technique, but who are not performing flights essential to the war effort or who are not engaged in CAP activities, may purchase time in half-hour blocks only and may not clear for another airport. For other specific information, pilots and plane owners should contact their nearest CAA office. Members of the AOPA may refer their problems to the AOPA Washington Service Office.

Wanted: Spare Parts

The number of inquiries from members regarding availability of spare parts increases each month. From other sources we learn that there are numerous partially disabled aircraft throughout the country whose owners have found it profitable to dissemble and sell off "piecemeal." AOPA has just begun to put these two things together, so we now invite members to advise the AOPA offices as to their requirements for used parts, and we urge all readers to forward to AOPA the names of persons or companies where spare parts may be procured. A particular case which we have been unable as yet to service is from a member who has need for plywood parts for a Cessna. This is only typical of the number now on file. Here is an opportunity for real co-operation with AOPA acting as middleman. In writing AOPA offices *always give complete details.* It saves time and postage. Engine parts are, of course, included in the above.

"Cockpit Clatter"

The response to the "trial balloon" which AOPA sent in the form of a special Washington newsletter entitled "Cockpit Clatter" has been far more encouraging than we had hoped for. All of the responses are being studied carefully and plans will be formulated to work up through this medium a way in which important news can be forwarded to members prior to their actual happening, when possible, or immediately upon receipt of word concerning new aviation developments.

We quote below unsolicited responses received from 20 AOPA members which reveal the keen interest which non-scheduled pilots throughout the U. S. are keeping alive during the war period.

" . . . compliment you on the newest idea—'Cockpit Clatter.' I surely will welcome it." **V. U. Young,** AOPA 2017.

"Received your much welcomed 'Cockpit Clatter' yesterday. It really is just what we AOPA'ers needed in order to keep up with this fast-moving world of aviation. I hope that you can continue this service." **Gordon E. Boen,** AOPA 8283.

"I have read your new 'Cockpit Clatter' Washington Newsletter and like the noise it makes a great deal. Please make every effort to continue the service." **Bernard G. Golden,** AOPA 2575.

"Your first issue of the AOPA Washington Newsletter was very interesting. I hope the general response leads you to continue with it—weekly." **H. S. Campbell,** AOPA 7401.

"Your first issue of 'Cockpit Clatter' of December 22 has been received by the writer and I want you to know that I was very much interested in the information it contained. I sincerely hope that as a member of the AOPA you will continue to keep me on your mailing list for this Newsletter. Keep up the good work!" **L. C. Van Nest,** AOPA 1857.

"Information from unofficial sources is a vital need today. Especially technological information. More power to you. The private aviator is a forgotten man." **J. B. Kenworthy,** AOPA 8279.

"The 'Cockpit Clatter' is swell—keep it up by all means. Just what a person like myself wants and needs. Too busy to spend any time at airports or read a paper, defense work all hours and no time!" **E. A. San Filippo,** AOPA 8562.

" . . . a fine effort on the part of AOPA and I hope you are able to continue it, as all owners and pilots are interested in every topic discussed. I hope you are flooded with mail such as this and that you can continue your enlightening letter." **Douglass C. Fonda,** AOPA 278.

" . . . although I have been a member of various aviation organizations over a period of the last eleven years, none compare with the AOPA, in my estimation. I think you are doing a grand job and trust you shall continue to do so. The Newsletter, by the way, was a pleasant surprise. Keep up the good work." **Mrs. Melva D. Gray,** AOPA 2777.

"Received 'Cockpit Clatter' and think it a swell idea. Keeps us up to date in a hurry!" **Sallie A. Honan,** AOPA 7927.

"I believe the Association should have done something like this long ago. I feel that every member should be willing to pay the few pennies a week such a letter would cost to print and mail if the Association could not afford to do it out of the present dues." **Earl C. Goekeler,** AOPA 776.

"Aside from the value of having up-to-the-minute information, this little Newsletter gives a personal touch to AOPA membership which is greatly appreciated. Hope you will be able to keep the Newsletter going." **E. Stanley Beck,** AOPA 937.

"With so many vague rumors these days concerning civilian flying, real information from your office is certainly appreciated. I hope this type of letter will become a regular service of the AOPA." **Mrs. Ruth E. Schreyer,** AOPA 8456.

"If the future copies contain as much news and information as your first one, I feel sure that it will go a long ways in the making up of a more worthwhile organization." **Ed H. Wagner,** AOPA 912.

"In my opinion this is one of AOPA's most useful projects." **Ward H. McMurdo,** AOPA 2840.

END

NEW ENGLAND AIRCRAFT SCHOOL

WHEN THE WAR IS WON

Training will count in the peace time jobs just as surely as it is counting now on every sky front the world over. And more and more of the better jobs will go to New England Aircraft School graduates because they have been trained with Yankee thoroughness. Training and experience guarantee their future. Watch N.E.A.S. men when the war is won.

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How to Prevent Air Sickness

(*Continued from page 60*)

Favorite remedies for preventing motion sickness may also be valuable because they lessen expectation of sickness. Many passengers have their own ideas about helpful measures, such as eating lemon or chewing gum, and each one is usually right about it for his particular individual case. The same pet remedy might not help another person.

Taking a bit of food or drink may also help, largely because it is a pleasant practice. It helps especially if taken on the ground just before taking off or during a short stop.

Still another result of experience with the motions of any vehicle is that they are no longer unexpected. It becomes possible to anticipate the motions unconsciously and brace yourself or compensate for them more or less automatically.

The widespread idea that motion sickness is a symptom of fear and a disease of cowards or sissies seems, in the light of scientific research, to be fallacy. It has never had much credence in the Navy, where it is well known that experienced sailors and heroic commanders can succumb to sickness if the weather gets bad enough or if the boat is one peculiarly adapted to sickening motion.

Here is a small part of the evidence:

1. Those "immune" to motion sickness are just as scared of a hypodermic injection as are the susceptible ones.

2. There are more men susceptible to motion sickness among college boxers, wrestlers and runners than among ordinary college students. Yet sissies do not usually choose these sports.

3. Airsick stewardesses on airliners do not leave the job when they are sick, but stick it out. This takes a certain amount of spunk.

4. Nausea in the air develops sometimes for the first time in highly experienced personnel—sometimes after 500 hours in the air. If it were due to fear, why would it not appear sooner?

5. Airsickness occurs in the same people who are made sick by automobiles and trains. Airplanes or ocean trips may frighten some people, but few individuals these days are actually scared by automobiles, trains and streetcars.

6. Many people confess to being very frightened in the air but do not get sick.

7. During the week of December 7, 1941, airline passengers were expecting air raids and were in some cases afraid, often nervous and almost universally excited. Stewardesses' reports and other statistical data indicate that airsickness showed a *decrease* during this week.

No completely sure-fire method yet exists for determining in advance whether a man will be unusually susceptible to airsickness or other motion sickness. So much depends on the type of training and weather he will run into. For this reason past history or physical and psychological make-up cannot be used to separate the sheep from the goats with assurance.

History of previous sickness in trains, autos or other vehicles has proved useful in picking those who are very sensitive. Special psychological tests have been developed which are also promising for this purpose.

By spinning the candidates in a rotating chair or running them up and down in an express elevator or swinging them in a slow swing or running cold water in their ears when they are tilted, it is possible to eliminate many who are made sick in this way.

But the group turned down on the basis of such tests would undoubtedly include some who might fly or ride the waves successfully without sickness if they had proper training.

There is also the real possibility that in some men who might otherwise never experience motion sickness, it could be induced by such tests. Some men might thus be spoiled for flying.

Proper training is the real key to both the prevention and cure of airsickness. Even chronic airsickness can, in many cases, be cured by careful training.

The following are rules for the instructor, based on the latest available scientific findings:

1. Take it easy at first. The student should be introduced gradually to the movements of flight. The first flights, especially of any student with a history of sickness, should be in smooth air, without spins or other nauseating maneuvers and free from any "show-off" procedures. *Don't wring them out.* Ever.
2. On rough days, the flights should at first be brief.
3. New maneuvers are a hazard. Spins, stalls, tight turns, etc., should be only briefly attempted the first time they are introduced.
4. Watch your student. If he appears to be getting sick the troublesome maneuvers should be discontinued (if possible without comment).
5. The instructor must assume responsibility. If a student gets airsick during dual instruction, *the instructor should be required to clean up the ship.* This is a rule applied by Ralph D. Barton, flight operator at Roches-

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ter, N. Y.; it has reduced the washouts from airsickness considerably—his instructors handle their students carefully.

6. Hangar flying helps. The student should know in advance what sort of movements he will experience during a flight. The more completely he is forewarned by full descriptions of maneuvers or by previous reading and *study*, the less disturbing the movements will be.
7. The student usually isn't as tough as the instructor. The instructor should avoid trying the same maneuvers over and over again; they should be varied and a short wait should be allowed between different acrobatics. This is a rule that has been found successful in the Navy.
8. The eyes are important. Navy instructors have been told to teach their students during acrobatics to keep their eyes out of the cockpit except for brief glances at the instruments. A point of reference should be selected a long way from the plane, on the ground, the horizon, or a cloud bank, according to the maneuver being executed, and the eyes kept on this point for orientation. A tight safety belt helps orientation and gives a sense of security.
9. Don't talk them into sickness. The instructor should avoid giving the student impression that he expects him to be sick. Questions about it should be matter-of-fact in manner.
10. Don't make them suspicious of your honesty. The instructor should not deny that airsickness is possible. The student, if he has had any previous experience with motion sickness, knows better. It would put the instructor in the position of the mother who praises the delight of spinach to her doubting offspring. The instructor should be ready to admit that occasionally people do get airsick.
11. Be optimistic. The instructor should show understanding, a certain amount of sympathy, but plenty of optimism. The airsick-expectant student should be told that it can be avoided, and that it is rarely chronic.
12. Plane motions aren't so strange as the beginner believes. Any descriptions which tie the motion of the plane in with familiar past experiences that did not induce sickness are helpful. If bumpy air bothers the student, tell him to close his eyes and imagine himself in the back seat of an automobile on a country road. The expectation of getting a thrill out of the plane's movement is to be preferred to the expectation of nausea, if the student is unable to meet the situation matter-of-factly. The student should try to analyze the motion and find something pleasant in it. He should look forward to getting a thrill out of a sudden drop.
13. You have to be the doctor. If the student does get sick, notice what sort of motion brought it on. Succeeding exposures to that particular motion should be very brief and moderate for a while. Try to find out whether any factors are involved aside from the motion of the plane. Is he flying on an empty stomach, after dietary indiscretions, fatigue or hangover, constipation or other illness? Try to avoid subsequent exposure to the same circumstances. See that the student keeps himself well-fed and physically fit. Susceptibles should be discouraged from heavy coffee drinking or smoking and especially from alcoholic hangovers. They should not dose themselves with any drugs in the belief that they will help.
14. Have an eye to costs. Cases of repeated airsickness in spite of proper training should either be allowed to resign or be assigned to pilot duties where exposure to sickness is least. They should *not* be assigned to non-pilot flight duties, where exposure to sickness is greatest.

Even in experienced flying personnel, airsickness will sometimes develop. For the man who is sick only under unusual circumstances, when the weather is bad or physical conditions poor, no particular measures of cure are needed other than to see that he is not repeatedly exposed to the same combination of conditions.

The rare case in which an experienced flyer develops *chronic airsickness* does require special treatment. He should be withdrawn temporarily from duty. Then he should be re-assigned to duty where the flights are short. When he has been re-accustomed to flight without sickness, he may be able to go back to duty involving long missions.

END

Glider Train

(*Continued from page 42*)

towplane was felt far more sharply in reduced speed and performance than when the same passenger was carried in a glider.

"It's just about the difference between lifting 200 pounds and pulling the same weight behind you in a wagon," he says.

Transport gliders will be designed for a wing-loading with full cargo as nearly identical as possible to the wing-loading of their towplane, Combs believes, permitting the entire flight to get off the ground at about the same moment, shortening the required take-off run.

FLYING

The advantages of such an arrangement were sharply apparent in an experimental flight by Combs and Corcoran under CAA observation, undertaken the day after their arrival in Denver. A 65-hp. Piper *Cub* trainer easily took a single glider off the ground after a reasonably short run. Both craft left the ground at the same time, and the *Cub's* light wing-loading actually enabled it to record a higher rate of climb, at much lower speed, than could be accomplished in single-tow behind the heavier, higher-powered Waco.

An attempt to tow two gliders behind the light ship, and experiments with some sort of tandem-towing arrangement are being planned by the Denver group in an effort to make a definite contribution to the fast-developing interest in the practicality of commercially-operated glider trains.

Later refinements will come, Combs believes, when every air locomotive will have its "tender," drawing gasoline for long hops from a fuel-bearing glider directly behind, and when mechanisms are perfected to permit attachment of fully-loaded gliders without halting the flight, such as now is done in the pick-up of air mail sacks.

END

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Letters

(*Continued from page 124*)

aviation, and in my estimation should be required reading for all connected with Naval aviation in any capacity. . . . Your magazine is of inestimable value to us in our procurement efforts. Keep up the splendid work."

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Lieutenant Commander, USNR
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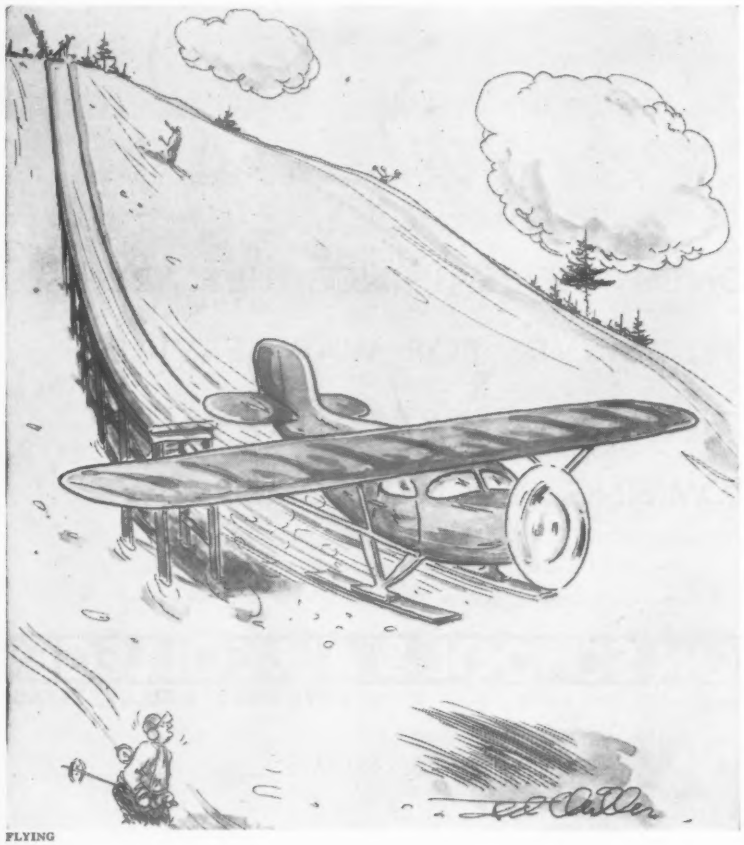

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Engineering an Airport

(*Continued from page* 45)

absolutely essential if the runways were to support arriving and departing aircraft without failure—and disaster!

In talking about base and fill construction, the word "stabilization" is used. It need not be as frightening as some of the soil scientists try to make it. A stabilized fill or base is simply one in which a proper admixture of gravels, sand and clays is packed under ideal moisture conditions into a firm, solid mass.

Every swimmer knows how hard the sands of a beach become while they are still wet from the waves and how soft and "unstable" they become when dried out. The proper mixture of soils under ideal moisture conditions becomes "stabilized" when rolled, in much the same way that the beach sand is stabilized when wet.

Two factors contribute greatly to stability. One is the friction of the particles of gravel, sand and clay upon each other. The other is a microscopic film of moisture around each soil particle, which has an attraction for the films around other soil particles. These factors are of varying importance depending upon the materials used, and close laboratory control of soil mixtures is essential to produce dependable bases. The big airport construction jobs have traveling laboratories which operate full-time to determine the proper mixtures for the various kinds of soils used and the proper amount of water to add to the mixture before compacting it.

Levelling the airport and building the fills is undoubtedly the most spectacular part of runway construction. Huge carrying scrapers, self-loading and self-dumping, can haul as much as 50 cubic yards at a time, though smaller ones of 12 to 18 yards are most often used. They are hauled by heavy crawler tractors or giant two-wheelers, and sometimes assisted in loading by another tractor nudging them from behind. But despite the large scale with which they work, the material they haul must all be suitable for strong fill material or it is discarded.

A typical airport job finds material being hauled a mile or more by a team of these hefty machines, running at speeds as high as 18 m.p.h., operating three shifts and moving as much as 20,000 cubic yards in a single day.

Once hauled, the fill material is placed in nine-inch layers by the scrapers themselves, the larger stones and rocks are removed, and sprinklers wet the material down thoroughly to the best moisture content determined in advance by laboratory tests. Following the sprinklers come sheepsfoot rollers which compact the material in successive passes. After each layer is rolled, a test of the compaction is made by a soils laboratory man.

The fills are made for varying depths, depending on how level the terrain was to begin with. When the compacting is finished, you might, with great difficulty, dig a hole down through the fill for 25 to 50 feet, in the rare occasions when that deep a fill would be placed. Once at the bottom of the hole you would look up to find the sides standing up solidly, as straight as a wall, without sheathing and showing clearly the layers in which the fill was constructed.

The development of modern methods of fill construction has made the surfaces of runways less important than most persons, to whom only the surface is visible, might imagine. The old maxim of McAdam is in force again; if the fill is sound and strong it will support almost any load. It is primarily necessary now only to protect it against the weather and such immediate surface damage as landing wheels might cause.

Some bituminous surfaces are only a couple of inches thick, and anyone who doubts that such a thin flexible skin can do the job when supported by a good base should try to imagine what the strongest reinforced concrete surface would be like if the subgrade were soft and unstable. Advocates of heavier pavings think of the pavement as a bridge built on a weak support rather than as a flexible protective coating built on a strong support, which is what most new runways tend to be.

Runway surfaces can be made of bituminous materials, reinforced concrete, soil cement and in certain instances the stabilized soil itself, to which the chemical calcium chloride may or may not be added to keep it moist and at the best water content. Whatever the surface, it must be dense, practically waterproof, and not have loose stones or gravel which would injure tires.

At present the minimum asphalt surface for use by bombers is considered to be three inches. It must be laid and mixed in such a way that it presents a smooth non-skid surface that will shed water quickly. Asphalt and other bituminous surfacings have the advantage of making use of subgrade strength and therefore require less thickness than the minimum necessary for any rigid surfacing.

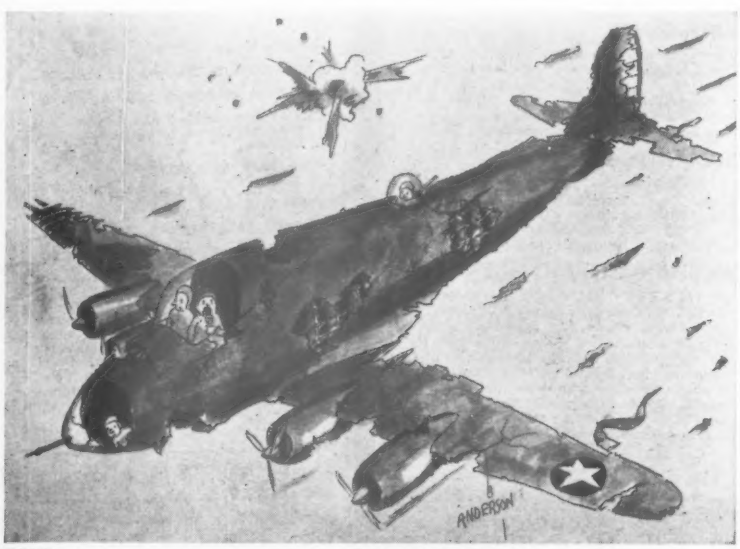
They adjust themselves readily to unequal settlement, their cost of maintenance is low, and they are more easily repaired after bomb damage. These surfaces are of various types, commonly called "black-tops," but they may be constructed by methods as different as being cold-mixed by machines on the runway, or hot-mixed in a stationary plant and hauled to the job. The bituminous material itself may be several grades of either tar or asphalt.

Instead of using reinforced concrete, a large number of airports recently constructed in the United States use the comparatively new soil cement. As its name suggests, soil cement is simply a mixture of the ordinary soil of the subgrade with cement and water. Soil cement is most commonly used where the existing base materials are not satisfactory. It is only used as a base and always covered with a bituminous wearing course.

A typical soil-cement base recently was built on a Texas airport because soil surveys indicated that the existing materials on the airport site would not provide a satisfactory base.

The soil varied from a heavy clay loam to a clay. Tests indicated that a 12 per cent admixture of Portland cement would provide a good six-inch base. In constructing this base, the top nine inches of soil were stripped off the surface and stockpiled at one side of the runway and taxiway area and the surface was graded and levelled.

Sheepsfoot rollers—heavy drums with tamping feet sticking out from them like enormous spikes—were run over the sub-



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grade until they had packed it so hard their feet travelled on the surface.

When this was completed, the stockpiled topsoil was hauled onto the subgrade to a depth one inch higher than the finished soil cement was to be. Roto-mixing machines then set about to pulverize the soil, which was necessary before cement could be added. This proved to be extremely difficult because this soil hardened into clods when dry and tended to form small balls when moist. Finally, with sheepsfoot rollers assisting, the soil was pulverized dry and cement was spread on the surface in 25-foot-wide strips.

With the cement spread, mixing machines began to mix the dry cement-soil mixture, then water was sprinkled over the 25-foot strip and wet mixing began, to be followed by the compacting.

A total width of 75 feet was treated in this way at one time, with three 25-foot lanes in successive stages of completion simultaneously. Dry-mixing might be going on in lane 3 while wet-mixing was going on in lane 2, and rolling was putting the finishing touches to lane 1.

It was necessary to maintain a close watch over the water content of the mixture. The exact amount necessary had, of course, been calculated in advance, but in this dry climate the mixture had to be sprinkled constantly to allow for evaporation.

Following compaction by the sheepsfoot rollers, the surface was bladed to the finished grade by a motor grader and then scratched with a heavy wire bristle broom-drag, followed by several trips by a pneumatic-tired roller until the surface was well knitted. Finally, the runway surfaces were covered with straw and kept moist for seven days while the soil-cement cured.

The whole job of surfacing 190,000 square yards of runways and taxiways was completed in 37 days. If the soils had been easier to work, the construction time could have been halved.

Such bases are not constructed to withstand wear from direct wheel contact and this particular job was given a light wearing surface of bituminous materials about 1½ inches thick.

In all these jobs, engineers, soil experts and laboratory technicians were constantly at work, overseeing the operations and making continuous tests. Despite its immensity, each airport construction project must be as specifically designed as a suit of clothes.

Quantities run into millions of yards and yet the huge modern earth-moving and earth-working machines do their jobs with precision and close tolerances. Despite all this, the basic principles still go back to a pioneering Scottish engineer who never saw an automobile and never dreamed of an airplane—John Loudon McAdam.

END

Autos to Aircraft

(*Continued from page 29*)

sandths of an inch and with tightly-checked specifications, the opportunities for production short cuts by arbitrary modifications of established design are distinctly limited, to say the least. We will introduce new techniques of procedure and assembly and manufacture based on long volume production experience but we can't tamper with designs belonging to someone else, generally speaking. In this connection a conservative policy is not only indicated, it is necessary.

In any mass production discussion the talk sooner or later reaches the conveyor systems which, to the public, have symbolized mass production as we knew it. With the entrance of the automotive industry into aircraft production the public immediately visualized the dramatic possibilities of great numbers of airplanes spewing from the end of speeding assembly lines. But, however symbolical the conveyor may be, it is in fact merely a detail of the production picture as a whole and to use them in the same manner that we did in automobile days we would first have to meet all the other rules of mass production previously outlined. True, conveyors are coming into general use in aircraft production. We are using them ourselves. Aside from their natural value they contribute to the "sense of flow" inherent in men who have devoted their lives to automotive mass production. But the conveyors in our aircraft factories are moving at a snail's pace compared to their automotive predecessors for the reasons I have discussed. Their progress is measured in feet-per-hour, not feet-per-minute.

Perhaps this article has been too negative in its approach. My intention has been to show what vitiates against a repetition of mass production *results* in aircraft plants as compared to automotive plants so that the public may be adequately informed on a subject vital to its own welfare. It has not been my intention to imply that our aircraft industry is not the finest in the world; it is. Or that the automotive industry has nothing to contribute; it has. Automotive production "know how" will contribute its full share to the qualitative and quantitative superiority of our airpower before this war has ended. Of that I am confident.

Already this "know how" is bearing fruit in production short cuts at our plants. Our product and process engineers and our ex-automobile employees as well, long steeped in production "know how," are constantly devising corner-cutting techniques and procedures. For example, one employee recently developed a new method of heat treating tools and dies enabling us to use "national emergency" steels rather than more critical steels, with no sacrifice in quality. His ideas have reduced the over-all time cycle for all operations in heat treat from 21 to four hours and the volume of critical materials needed by 75 per cent. In addition, fuel requirements have been cut to one-sixth the former total. Another employee substituted machine drilling for hand drilling in locating holes for the main beam of a wing section. Now one man can finish in two hours a job which formerly occupied two men for eight hours. And this doesn't take into account the greater accuracy achieved. There are hundreds of other develop-

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ments constantly under way but it is still a little too early to discuss them.

"Know how" is neither miracle nor magic although it has been called both by the uninitiate. "Boss" Kettering, if I may quote him again, has reduced the phrase to a simple analogy. He likens "know how" to the way Fritz Kreisler plays the violin. A violin, he says, is not very complicated. It has four strings and is played with a horsehair bow. Mechanically, anybody can understand it. But when Fritz Kreisler plays the violin he can fill Carnegie Hall at $2.50 a seat. Somebody else can play it and the neighbors will call the police. Then why couldn't Fritz Kreisler write a book telling how he does it? He can't because the simple secret of his genius is that he has been practicing on that violin since he was six years old. There is a fine co-ordination between his fingers and the bow and everything else. There are only a few things to co-ordinate there but the way he does it makes all the difference. That, in a sense, is what you might call management and planning. That is "know how" which, in the final analysis is practice, practice, practice. With it you can build anything whether it be an auto, an airplane or a magneto.

As a result of this practice or "know how" the automotive industry has acquired an unequalled knack of controlling materials and planning schedules. Years of practice have given it pre-eminence in breaking down separate operations to their most economical components for manufacturing. "Know how" has given it the ability to balance production operations in a manner that keeps waste effort at a minimum. This sort of thing is now in the process of being applied to a new productive effort. Techniques may differ but the result is improved production.

Perhaps it is still too early to catalogue contributions of technique and procedure by automotive people in aircraft work that would equal what they have already contributed to the manufacture of guns, tanks, trucks and other forms of special mechanized equipment for military purposes. But this catalogue is rapidly developing as the examples I have already listed above indicate. Soon the developments of automotive process and product engineers will be something to write about because, in my opinion, we are "over the hump" as far as co-operation with the aircraft industry is concerned. From here in there is certain to be a freer trading of tricks between the two industries and a better understanding of the problems common to each. Both sides are taking fuller advantages of the other's specialized "know how." And as new designs emerge this new closer relationship cannot help but result in airplane designs that will be easier and more economical to manufacture and in performance that will be more effective than the world has ever known.

END

Pilots' Health Commandments

(*Continued from page 52*)

ing should clean not merely the teeth but the whole mouth. The brush should be laid flat against the center roof of the mouth, turned firmly so the bristles massage the tissue as the brush is drawn across the palette and down off the inner side of the teeth. When the interior of the upper part of the mouth is clean, the brush is laid firmly against the gum tissue with bristles pointing upward, and then turned to bring the bristles in firm contact with the gum tissue as the brush is raked down over the outside of the upper teeth. Of course the action for the lower jaw is in reverse. Such a cleansing takes off food particles, but also massages and cleans the tissue around the teeth without pushing gum tissue away from the teeth to expose soft tooth structure below the gumline.

Any abnormality of the abdomen, pelvis or genito-urinary system should be corrected before examination. A hernia, for instance, may cause excruciating pain in flight either because of a blow from a control or because of gas distention in the bowels, common at the low pressure of high altitudes.

There are relatively few incorrectible deficiencies in the average candidate. Such things as mentioned may be incorrectible because of degree. Concussion or skull fracture which caused the patient to be unconscious any length of time with possibly unhappy changes as late as two or three years afterwards, migraine, epilepsy, persistent fainting, a radical mastoid or deformities of any gross nature are obviously disqualifying. In the same category are sleepwalking, night-terrors, sex perversions, bladder or bowel incontinence.

More often the pilot has some lesser trouble, being underweight, overweight, having bad acne or being too short.

The overweight person, in the hands of a sympathetic, competent physician, does not have too difficult a problem. The writer knows of one client in a New York salon who, after years of dieting, exercise, medicine and hopelessness, lost over 100 pounds between November and June—and has reached a new high in health. Such radical reduction calls for strict but not inhuman dieting: raw fruits and salads, of course, but also thick steaks and baked potatoes. Exercise must be faithful, but not killing. Such results demand the most careful medical supervision.

The underweight person often has a harder problem. As often as not, assuming there is no organic difficulty, he is underweight because of a nervous disposition that keeps him burning off fat as fast as he can produce it. For him is suggested a diet of fattening foods, an hour of active exercise outdoors *before* each of his three main meals with an hour of rest in bed *after* each of these meals, an extra lunch at mid-morning and mid-afternoon and bedtime, vitamin concentrates with especial attention to the anti-neurotic and appetite building

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AOPA Pilot No. 7112

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Acne takes patience, sometimes a dermatologist and gland-extract injections. A thrice-daily scrubbing with physician-and-surgeon's soap, a nightly application of drying acne lotion, diet rich in raw fruits and fruit juices, at least 10 glasses of water daily, good elimination, determination to keep fingernails from the face—these may do the job. An application of oat-and-almond meal paste, made up for acne by cosmetic houses, can be applied daily, allowed to dry, and then rubbed off vigorously. The victim may find the "beauty angle" mentioned in the eye discussion helpful, too, in that it does bring blood up for nourishment and cleansing.

Even shortness is not always hopeless. As much as an inch and a half can possibly be added. The first problem is proper posture. Don't "throw back your shoulders and stick out your chest." That is equally hard on back and nerves. Deliberately relax the knees to a slight bend. Tuck in your tail. Dig back your waistline until your back is one straight line from head to knees. Then lift the rib cage (not the shoulders) in front. As a consequence, the shoulders drop, not lift or strain, into place, and the neck lifts the head directly up. In perfect position, stretch your neck up behind your ears, pulling your chin in, until your neck is stretched as far as possible, then lift your chin to level, keeping the stretch. You not only have straightened the whole spine now to allow cartilage cushions to expand and add height, but neck muscles lengthen and, over a period of six weeks to two months, you'll probably find yourself taller. Further, in anatomically correct posture, your vital organs are in place, and you are not as subject to nausea from sudden maneuvers.

Don't try to be your own doctor, but you can observe common sense corrections and rules. The wise pilot keeps certain "commandments" in mind:

He guards his eyes. He uses goggles for open-cockpit flying to protect his eyes from foreign matter and from the beating wind. He uses anti-glare goggles in bright sunlight or over snow or water. He uses eyewash frequently. He does not use his eyes for close work without proper, shaded lights. He remembers that vision can be impaired by fatigue, indigestion, loss of sleep or nervousness—and promptly goes to his doctor for help if he sees double or has indistinct or blurred vision.

He preserves hearing and balance by keeping nasal and aural passages clear and avoids flying when afflicted with a cold or sore throat. He has adenoids and tonsils checked and has treatment for nasal catarrh, a deviated or broken septum or other obstruction which interferes with free breathing or decreases mental efficiency through impaired aeration of the blood.

He protects circulation through warm, unhampering clothing, drinks little coffee or tea and no alcohol before flying. Alcohol, especially at high altitudes, requires oxygen for its assimilation and cuts down seriously on blood aeration. He protects digestion through avoiding a heavy protein or high cellulose diet which would cause gas and, at higher altitudes, painful cramps, and he avoids overheating from a too starchy or sugar laden diet.

He protects digestion through properly balanced food, plenty of water and emotional serenity.

The rules for a flyer provides for a semi-yearly checkup at least. What he does before and between checkups is up to him. And most of us, happily, are basically all right.

END

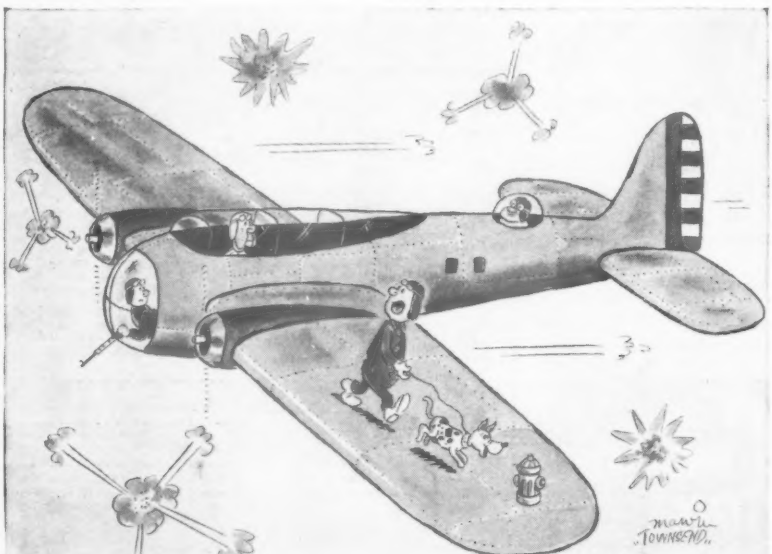
Communications School

(*Continued from page 80*)

fan marker, inner marker, outer marker or Z marker. The public aeronautical station is a land station licensed for communicating with the public service aircraft stations, as a public aviation service. Also associated with the services and types of stations in use are the "chains of stations," a series of co-ordinated stations operating on frequencies allocated to aviation services in accordance with an approved plan.

All radio operators must be licensed in accordance with Federal Communications Commission regulations. Thus at this school, they are trained so that they may pass the necessary examinations to secure such a license.

In transcontinental and transoceanic air travel, foreign languages are encountered. It is necessary for the operator to be able to converse with operators who are not familiar with English.



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The operation and maintenance of equipment is another phase of study given close attention. In the theoretical study of radio such topics as direct current, alternating current, vacuum tube applications, audio apparatus, oscillators, radio waves and transmission, transmitters, modulation, receivers and antennas are covered.

A detailed study of various types of equipment is also a vital portion of the study plan. This equipment covers receivers, transmitters, frequency meters, monitors, auto alarms, radio beacons, direction finders, radio compasses, etc.

In view of the specific design of the equipment used in both the land and air stations, it is necessary to be particularly careful in the study of these units. For the frequencies used in this type of equipment not only are different from those used under ordinary circumstances, but their application is unusual, too. Thus, one standard two way unit may operate in the high frequency band of 2.5 to 12 megacycles, while another unit designated as a local two-way may operate in the ultra-high frequency band of 140 to 143 megacycles. The standard two-way channels are used within the 2.5 to 12 megacycle band to provide medium distance coverage for communications with ground stations and also to provide channels for long distance coverage, so that the plane may communicate direct with the dispatch center. Available channels in the high frequency band will permit the selection of the channel best suited for specified coverage with due consideration to the day and night as well as the seasonal characteristics of high frequency distribution.

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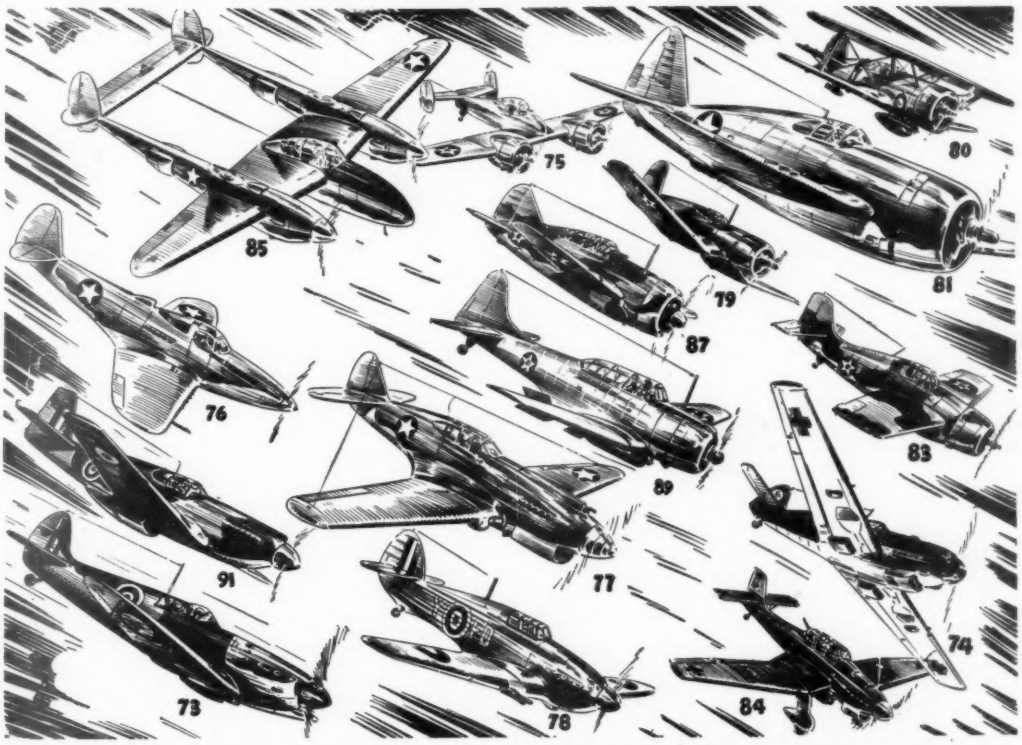

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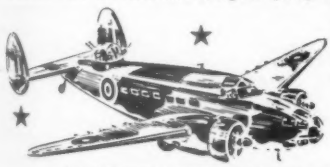

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for local communications. This service is well suited for communications near the airport and will cover the operation of landing and take-off communications. Since the 140 megacycle band transmission is limited to the optical path, a great reduction of airport noise is also achieved. In addition the reduction of atmospherics on ultra high frequencies as compared with the high frequencies is of great value in maintaining consistent communications.

In addition to being taught that communication with airline ground stations requires these various channels, students also are shown that there are certain channels designated for the purpose of contacting, for instance, the airport traffic control tower. This is an important topic of study since these channels are vital to the procedure for the systematic arrival and departure of traffic.

Among the radio navigational aids used on board an airliner that receive strict attention by the students are the beacon receivers, direction finders, automatic compass and marker receiver. This equipment is used in conjunction with such ground facilities as the simultaneous range station. This transmits a directional beacon signal and, at specified intervals, weather reports by way of voice at the same time as the beacon signals. These stations operate in the 200 to 400 kilocycle band. Two transmitters are used in this process, with one transmitter alternately connected to one of the two sections of an antenna known as a modified Adcock antenna. The input to one antenna is keyed "A," while the other is keyed "N." Thus the operator must be extremely alert to recognize these characters, for the keying is done in such a manner so that the "A" and "N" interlock in the equi-signal zones, resulting in a continuous tone. At intervals of 30 seconds, an identifying signal (which designates the name of the station) is transmitted first on the antenna keyed "N"and then on the antenna that is keyed "A."

Since phone is also used extensively on airline service, the ability to speak clearly is another important requirement of an operator. Accordingly specific courses are given in diction. This training is conducted during regular studio classes as well as during airline procedure. Recordings of voice are made to permit the student to gauge his or her progress. During regular procedure, messages are fed to the room board as well as to a typical airline circuit. Thus the student becomes acclimated to standard airline practice. This method of "actual-service" training is also employed in the code instruction rooms. Every possible type of message on a variety of forms are fed over the various circuits. Copying on the typewriter, by hand and by way of tape, are taught. Students are individually watched or listened to, with the aid of a specially constructed multi-channel board. Thus it is not necessary for the instructor to step down among the students and disturb their copying speeds. If the instructor, while listening in, detects an error, he calls it to the attention of that particular student.

Women are finding their importance increasing at the various ground quarters, not only as operators but for the maintenance of equipment too.

Some of the women have become so expert that other agencies have acquired their services. There is the case of Dorothy Kaufman of Brooklyn, N. Y., who was recently sworn in as a member of the radio division of the WAVES. Miss Kaufman, a former designer and secretary, studied at the Melville school for three and one-half months and obtained a second class radiophone license when actually only half-way through her course.

Another member of the fair sex who also achieved prominence in radio circles through her Melville school is Katharine MacDonald, who was sworn in as a member of the Women's Auxiliary Hospital Reserve Corp.

Many of the graduates are using their specialized knowledge elsewhere than the airlines, too, as members of the Signal Corps, as well as the communication branches of the Marines, the Navy, Merchant Marine and the Air Forces.

END

London Survey

(*Continued from page* 43)

For a variety of reasons therefore, this new lease on life of the *Merlin* is a matter of intense gratification in Great Britain. There are, of course, new engines in development and new aircraft have been designed to make use of them, but without having to wait for them, we have been able to put an existing British fighter on something more than equal terms with the best the enemy has so far produced.

* * *

With good news of this nature the temptation naturally is to put it first. There have been one or two other pieces of information lately which were not so good. One was that the Ministry of Aircraft Production had displaced the management of one aircraft firm and put its own nominee in with all the powers of a managing director. The onlooker is naturally inclined to wonder if this is a sign of more widespread trouble in the industry. In fact, it is less a token of inefficiency than of inexperience.

Those who know the British industry will not need to be told how small were the orders it received before the war and how consequently it was lacking in the tricks of fast production. During the past three years, most of the old firms in the industry have developed big-scale production schemes and, with financial help from the Government, have expanded beyond their wildest hopes. A tiny minority alone has apparently failed to tie up closely enough the design and production sides. A design which yields an admirable aeroplane may not lend itself to big production unless that side of

the question has been prominently in the mind of the designer from the start.

Such troubles, and the difficulties which may arise from unimaginative organization in the production shops, are likely to be found in any industry. The action of the Ministry of Aircraft Production in the case of one firm is not by any means an indictment of the industry but rather a sign that the new Minister of Aircraft Production (Sir Stafford Cripps) intends to allow nothing to stand in the way of high output. If it means that he is going to cut lots of red tape as well, nobody but the bureaucrats will grumble.

* * *

Another trouble which has begun to show itself is one which United States enterprise has largely forced on us. That is the dissatisfaction which is now being expressed in Parliament and in the press, with the neglect of commercial air transport by the British Government. Starting the war as we did with a desperate numerical inferiority in aircraft, the Government has steadily set its face against permitting the construction of civil types. Perhaps a dozen airliners which were on order before the war have been delivered to the civil companies. A few more, of similar type may have been built for communications work in the RAF. Beyond that nothing has been done.

Now that air transport is needed in large quantities by our armed forces, we have to rely on our Allies on the other side of the Atlantic to supply it; and those who best know the needs and the advantages to be gained are devoutly thankful that the United States can make good our deficiency. There is warm admiration in this country of the way in which branches of the U. S. Air Transport Command have opened up and operated routes serving the war areas. That very admiration deepens the consciousness of British inadequacy in the field of air transport.

Not only is Great Britain not building transports. She is also not designing transports, nor is she engaged in development work directed towards the evolution of transports at some reasonable date in the future. That is not to say that individual firms are giving no thought to the morrow, but control of design staffs, of labor and of materials is so strict that any serious development work without Government approval is impossible. One piece of transport production is in hand. That is the modification of one of the four engined bombers—which one we are not allowed yet to indicate—for use as a passenger transport.

The name of the new transport has been revealed as the *York*. Those, who like to let their fancy play around the historical associations of the names *York* and *Lancaster* are at liberty to make a guess as to which big bomber has been selected for transformation. We in this country are glad to have the promise of one converted bomber but that promise does not allay British anxiety about the future of air transport.

We frankly do not want to have to

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leave all the civil carrying to the United States when the war is over. That would be bad for the British aircraft industry and it would mean the disappointment of those enterprising operators in the British dominions who have laid the foundations of long-distance air services. The agitation now begun is likely therefore to gather weight and, as the Government has lately taken advice on the form which international flying should take, we look hopefully to a more forward-looking and constructive policy.

* * *

A final word may be acceptable on the work of some of the American aircraft which are operating from Great Britain.

The Lockheed *Hudson,* of course, established itself long ago as an admirable reconnaissance machine. I doubt whether the *Ventura* will equal or surpass its reputation either on over-sea work or as a bomber. The North American *Mustang* is a tremendous success with the Army Co-operation Command and as an "intruder," strafing trains, airfields, small factories and the like. The Consolidated *Liberators* and Boeing *Fortresses* are having so serious an effect on enemy fighter morale when the weather is good enough to go out, that the Germans are trying to pretend that those raids are made not by Americans but by the British and, as is their custom, are announcing only Allied losses and denying their own.

This survey may be brought full circle by the expression of a final regret that the *Fortresses* are not suitable in their present forms (B-17E) for use at night. The limiting factor is the exhaust-driven supercharger. *Fortresses* with superchargers of the more conservative type would not suffer from the same high risk of detection in the dark. There is some significance in the fact that the Germans who were experimenting with the exhaust-driven blower before the war have not used it on any of their wartime aircraft.

Those bombers which do use it, will have to operate by day only and will have to defend themselves when they go over Germany until there are enough long-range fighters to escort them or until the Allied Nations can seize bases nearer to Germany.

END

Flight in Nature

(*Continued from page* 48)

record with some hesitation although other evidence suggests that this bird can at times exceed 100); duck hawk, 200—plus.

This last record is so interesting I think the full details should be given. The incident, which occurred several years ago, is recounted in one of Bent's "Life Histories of North American Birds" issued by the U. S. National Museum and is, I believe, fully authentic. A pilot was flying a small pursuit plane which had a normal speed of 125 m.p.h. While at a considerable altitude the pilot spied some ducks beneath him and, thinking the experience would be useful, he went into a dive at them. As he was going down he glanced at a wing tip and was amazed to see a duck hawk also going for the ducks—and going faster than he was!

The duck hawk got to the ducks first, knocked one senseless and made off. The pilot said that at the moment the bird passed him the speedometer was registering 175 m.p.h. and in his opinion the bird was travelling "as though the plane was standing still . . . swooping two feet to his one." When all allowances for possible errors are taken into consideration, I don't see that a speed of *less* than 200 m.p.h. for that duck hawk can be claimed and probably well over that speed. (Somewhat similar incidents with eagles indicate that they also can top the 200 mark when really going places.)

Wonderful as is the air-mastery of birds, even they must yield the palm for speed of maneuver to the most expert-flying insects. Some entomologists believe that certain insects, e. g. dragon- and damsel-flies, have achieved the supreme maneuver of flight—the ability to stop dead on a fixed point in the air and then, still facing the same way, dart at full speed either backward or sideways.

There used to be a wonderfully ingenious scientist at the College dé France in Paris, named Magnan, who conducted many experiments on insect flight. The better to study the actual mechanism of flight Magnan used an ultra-high-speed camera capable of taking nearly 30,000 pictures *per second.* By closely examining the films thus taken it was possible to observe things connected with the flight of insects which the unaided human eye could not even begin to see.

Here is one passage (translated) from a report Magnan made:

> "With the hover fly one sees the creature perform on the spot real turns in full flight so well that, at a given moment, the insect is found with its feet in the air, its back underneath. In the same way, I have observed in the natural flight of a fly, the performance of a veritable somersault such as airplanes do not make. . . . It is worth noting that the changes are often sudden and happen in a very short time, somewhere about one thousandth of a second; the somersault, for example, taking place in one hundredth of a second."

A loop in one hundredth of a second! An insect does not merely flap its wings up and down; they go through a movement which, in its effect, is akin to a propeller. An entomologist attached bits of gold leaf to the wing tips of a wasp and then threw a beam of strong light upon them. He found that the vibrating wings were describing the form of a figure 8.

The German investigator, Demoll, once carried out an experiment to determine the precise effect of an insect's wings on the surrounding air. He suspended sev-

eral rows of fine owl feathers from a frame and then secured an insect in such a way that its wing movements would not be hindered. The air currents set up by the insect's whirring wings were thus registered in the displacement of the feathers.

Demoll found by this experiment that the currents of air drawn by the vibrations of an insect's wings come not only from in front but also from above, from the sides and from below and are all thrown off at the rear. An insect's wings would therefore appear to possess greater efficiency than a propeller and to have the flying mechanism of a helicopter, except that in the insect the wings neatly combine the function of two sets of airscrews working at right angles to each other.

In the report which appeared in the German technical journal to which I referred earlier, reference was made to the tiny bristles and other formations on the leading edges of many insects' wings. The interesting suggestion was made that these growths may create turbulence in the boundary layer of air and thus check the back-flow with its corresponding loss of lift. Perhaps enough attention has not been paid in the past to insect flight and its mechanism, especially by our aircraft designers.

The relative speed of an insect can be judged by the shape of its wings. The slow flyers generally have broad wings, and in flying keep the wing surfaces almost horizontal and fly in the manner of small birds. Swift flying insects have narrow wings, with good aspect ratios, and turn the surfaces more nearly vertical with each stroke. Generally speaking, the longest species of each group of insects fly the quickest.

Timing the speed of insects is very difficult. Demoll solved the problem by setting various insects at liberty in a room lighted by one window and recording the time in which they flew direct from the dark side of the room to the light. But it is to the patient Magnan that one must turn for the most painstaking and original method of clocking insects in flight.

Magnan constructed a weird and complicated apparatus whereby insects were harnessed by very thin silk cords to a delicate machine which recorded how much cord was taken out by the flying insect and the time taken. A simple calculation then gave the speed at which the insect had travelled.

The following list gives some representative speeds in miles per hour, which were obtained by Magnan and by the use of other methods. The list may prove of interest in view of the highly exaggerated speeds which are sometimes given for insects in flight. I have met estimates of 500 m.p.h. for a wasp and 800 for the American bot-fly!

Mayfly, 1.1; mosquito, 3.1; cranefly, 4.4; housefly, 5; bluebottle, 6; cockchafer, 6.6; hoverfly, 7.7; red admiral, 8.8; wasp, 12; hornet, 13.3; robberfly, 15; scarce aeshna, 15.4; honeybee, 25; horsefly, 30; small dragon-fly, 30; hawk moth, 33; dragon-fly, (Australian species) 55.

END

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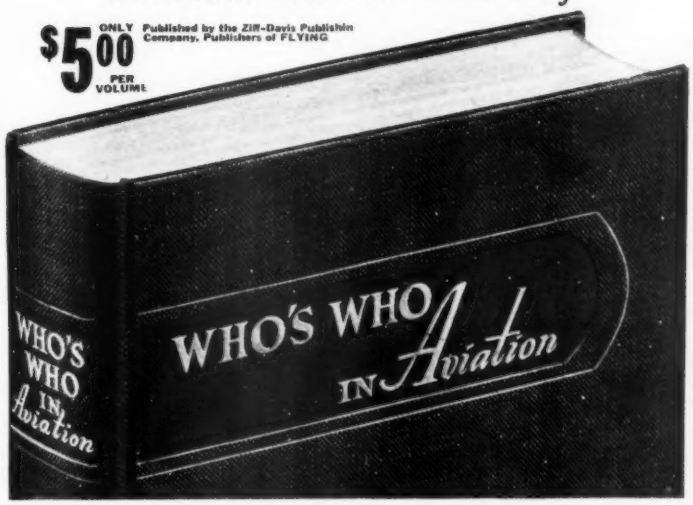
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15 YEARS AGO

FROM the April, 1928 issue of this magazine:

Ben Eileson lauded as the first blazer of commercial aviation trails in Alaska . . . Joseph LeBrix and Dieudonne Costes demonstrated the advantages of precision instrument flying when they flew from Maxwell Field to Ft. Humphreys, Va., through a heavy fog and entirely without landmark guidance . . . George H. Dacy recounted the 16 years of testing aircraft in miniature by the Navy Department.

* * *

Lieut. Victor E. Bertrandias, stationed at the Douglas company by the Army, allowed an aircraft inspector is necessary and is "an inquisitive creature with a tactful disposition". . . Galt Joint Union High School, Galt, Calif., had the first secondary school course in aeronautical science . . . Edgar N. Gott, president of the Keystone Aircraft Corp., said isolated and unexplored places in Peru would be opened by the airplane.

* * *

Will Rogers was suggested to head a joint committee to settle the misunderstanding between the Smithsonian Institute and Orville Wright . . . Business men were awakening to the advantages of the air mail service . . . Small plane dealers would soon be ordering planes from the manufacturer in lots of a dozen and flying them away as autos are now driven from manufacturer to salesrooms, a story itemized.

* * *

The oftener a man flies the better and safer pilot he is, revealed the Navy Bureau of Aeronautics . . . Charles Lindbergh has about as much privacy "as a gold fish," observed Irvin Cobb. "Let him devote himself to private affairs". . . Air travel was cheaper for the business man when you considered salaried working hours saved by the man who flew . . . Naval aviator, Lieut. Alford J. Williams, flew the first upside-down-outside loop . . . Supply officer at the Washington Navy Yard found an old box labeled "Aeroplane." Shipped to the Anacostia Naval Air Station, the box disgorged a pre-World War floatplane . . . A new air service between Santo Domingo and San Juan has been established. Fare is $50 . . . Akron Airport, Inc., had been founded. A short-wave transmitting set was to be installed at the field . . . A new hangar, 70x100 ft., had been opened at Cleveland Airport.

* * *

An air ambulance was operating out of San Antonio, Tex. . . . The Army allowed municipalities to use military fields if the townships showed that eventually they will open their own airports . . . Paul F. Collins, National Air Transport mail pilot, flew low over a burning house and saved the lives of six children and their parents. The roar of his motor awakened them.

END

Stanton

(*Continued from page 60*)

many advantages. They eliminate crucial bottlenecks along the production line, their use simplifies many problems of fabrication and assembly, and the supply of these materials is practically inexhaustible.

Take the new Curtiss *Caravan*, for example, the first plane to be built almost entirely of non-strategic materials and specifically for military cargo purposes. More than two-thirds of the plane is built by sub-contractors in the woodworking industry—by a piano company in Ohio, a Virginia company specializing in molded products and a plywood concern in Kentucky which has been making tobacco hogsheads, Army bunks, ammunition boxes and bodies for trucks and station wagons. Thus it taps a new source of labor and skills hitherto not identified with aircraft production. Completed sub-assemblies will flow into the main production line to be fitted together and finished planes will roll off the end of the line in great numbers.

Made largely of hickory, spruce, birch, gum, mahogany and Douglass fir, the *Caravan* is a specialized workhorse, designed for short runs of 600-700 miles, with frequent stops. It can carry parachute troops, air-borne task forces, jeeps, reconnaissance cars, shells, guns, airplane engines, propellers and spare parts, medical supplies and litters and many other kinds of urgently needed military supplies and equipment. In addition, it has fittings to tow gliders.

A high-wing monoplane, the *Caravan* is powered with two 1,200 hp. motors, either of which can sustain the ship at an altitude of 5,000 feet. With low take-off and landing speeds, this large plane can get in and out of small fields in almost any kind of terrain, and should prove to be particularly useful in out-of-the-way areas in Alaska and South America where there are few or no facilities for repairing metal planes. With its tricycle landing gear, the ship sits level when at rest, a great advantage in loading and unloading, and requires no special ramp for handling cargo. If needed, one can be quickly improvised with shovel and earth, for the floor of the cargo hold is only 36 inches off the ground.

Other ships are being built to do other special jobs—everything from improved "puddle-jumpers" now serving in the Field Artillery's "Grasshopper Squadrons" to the huge Martin *Mars*, the still larger Kaiser-Hughes flying boat, and Lockheed's new *Constellation*, a four-motored land-based transport designed to travel Great Circle routes through the stratosphere at a speed above that of a Japanese Zero and many other pursuit planes. It can hop the Atlantic with 55 passengers—more than half the number of Pilgrims on the *Mayflower*—in nine hours. It places all of Central and South America within overnight hop of all of our major cities.

What does all this portend?

It is always hazardous to assume the

mantle of a prophet, but one can suggest certain probable developments without risk of going completely off the deep end.

After the war there is going to be a tremendous boom in private flying. Aviation has taken the popular imagination by storm. Our Army plans an Air Force of 2,500,000 men. Not all of these will be pilots by any means, perhaps not more than a tenth of them. But almost all of them, if my own recollection of the days immediately following the last war is any criterion, will try to cling to aviation as a vocation or avocation. The country will be peppered with large and small flying fields—some individually owned, many more in the hands of small commercial operators with a fleet of small to medium-sized airplanes available for long or short charter flights, flight instruction, and rental. For the latter purpose I expect to see increasing numbers of the non-spinnable safety-type aircraft and, within a year or two, helicopters should begin to appear in the "stables" of the better equipped operators.

Passenger service on the airlines will increase many times over. For the year ending April 30, 1942, the domestic airlines flew 1,500,000,000 passenger miles. During 1946, according to the Civil Aeronautics Board in a recent estimate based upon past performance, the airlines will be flying 6,000,000,000 passenger miles, which will require a five-fold increase in the 1941 carrying-capacity of the airlines —roughly the equivalent to 500 aircraft of the four-engined 40-50 passenger type which was just commencing service on the scheduled air carrier system during 1941. However, many additional aircraft will be needed for cargo operations, and the "old" DC-3's can be used for that, as well as many current bomber models.

Using the same years as a basis of comparison, the CAB estimates that international air passenger traffic will increase about six times; and mail and express traffic, at least eight times.

Domestic air express has been rapidly rising, and will continue to do so. During October, 1942, it was 123 per cent larger than for the same month in the preceding year. All domestic first-class mail will go by plane except that which can reach its destination in time for equally early delivery by surface transportation. There will be non-stop pick-up mail service for smaller communities, a type of service which has had a thorough three years' test on routes totalling almost 1,500 miles.

But in spite of the claims of many whose opinions I respect, I remain skeptical about the immediate possibility of the plane carrying any considerable amount of general freight. Enthusiasts have pictured the plane taking over the larger part of our transportation services while cobwebs collect upon our steamships, railroads, busses and trucks. Such extravagant claims mislead the public, create expectations which cannot be met and could well injure the very activity they are intended to promote.

The nub of the question here and in all commercial air operations is relative costs in comparison with other forms of transportation, as recently pointed out in graphic detail by W. L. Runciman, director-general of British Overseas Airways, and W. A. Patterson, president of United Air Lines. Traffic is like water in always seeking the lowest levels—that is, it tends to flow along the cheapest means of transportation, other things being equal. Higher rates will be paid only when some compensatory advantage is gained by greater speed in delivery, convenience and flexibility of service, or some similar factor. Air transport offers speed, convenience, and flexibility of service, but the differential between plane rates per ton-mile and those offered by truck, railroad and steamship is still very large.

The plane has a broad and important part to play in our transportation network. It will do its essential job by supplementing—not by supplanting—other means of transport. In its field there is, I believe, almost no limit to its future.

CHARLES I. STANTON,
Washington, D. C.

END

Marine Airmen on Guadalcanal

(*Continued from page 24*)

and six transports sunk, three left burning and one possibly sunk.

The dive bombers, although not supposed to be a match for fighter planes, also destroyed 20 Zeros, eight in the air and 12 on the ground. Add to the accomplishments of the dive bombers the great work of the Army's heavy and medium bombers, the torpedo planes and fighters and the importance of Guadalcanal as an airbase becomes apparent. Truly, it served as a rat trap which was fatal for a substantial measure of Jap military strength.

Typical attack missions were carried out by the dive bombers from December 12 to December 27 which involved a total of 108 planes. Protected by Grumman *Wildcats* as well as by Army *Lightnings* and *Airacobras*, the dive bombers dropped 106 500-pound bombs and 212 100-pounders. They scored 19 hits on runways, 35 on gun emplacements, 41 hits on ammunition and supply dumps and 15 on enemy planes on the ground. Four Jap planes were shot from the air, one destroyer was damaged and 18 smaller craft were sunk or damaged.

From the standpoint of the magnitude of the operation, the conquest of Guadalcanal can be regarded as the greatest in which Marine Corps aviation has ever participated. It should not be forgotten, however, that Marine flyers already had won undying fame in this war before the invasion of the Solomons was undertaken. The heroic performance of the gallant little fighter squadron based on Wake Island thrilled the Allied world in the opening days of the war. And it was Marine Fighting Squadron 221 which bore the brunt of the Jap aerial onslaught against Midway Island itself last June 4—a major phase of what history may decide was the crucial engagement, the turning point of the war in the Pacific. All the pilots of Fighting 221 as well as the pilots and gunners of Marine Scout Bombing Squadron 241, the latter participating in the attack on the Jap invasion fleet, have been decorated for heroic achievement in the Midway action. Thirty-eight of the awards were made posthumously.

The entire defense of Midway fell to Fighting 221 when the Japs came over just after dawn on that beautiful June morning. The squadron took off, 25 strong, to engage an enemy force of more than 100 bombers and fighters winging

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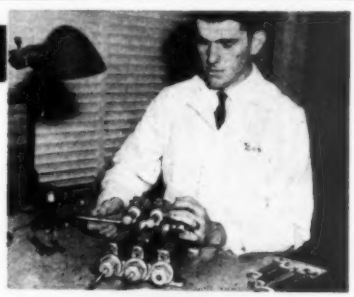

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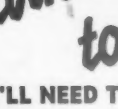

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their way in from their carriers far at sea. The Marines had mostly obsolescent Brewsters and pitifully few Grumman *Wildcats*.

About the same time, Scout Bombing 241 roared away from Midway to seek out the enemy's surface ships. Not a single fighter could be spared to escort them.

When Fighting 221 and the enemy aircraft clashed, a terrific melee ensued and within a 30-mile radius of Midway, planes began falling in flames into the sea. So effectively did Fighting 221 break up the Jap attack that the vital Midway airfield was never out of commission on that critical day. Only 12 of the 25 fighter planes got back to the island and six of their pilots were wounded but the survivors had the satisfaction of knowing they had downed 43 of the enemy aircraft. The missing American pilots doubtless accounted for other Jap planes which could not be claimed officially for lack of proof.

Meanwhile, the escortless dive bombers from Midway were pressing home almost suicidal attacks on the Jap fleet. One bombing squadron was commanded by the late Maj. Lofton R. Henderson, USMC, who crashed his flaming plane into a Japanese carrier, believed to have been the *Soryu*, an act which cost him his life and won him the posthumous award of the Navy Cross.

Diving repeatedly to within less than 500 feet of their targets, their rear gunners blazing away at Zeros trying to break up the attack, the bombers inflicted severe damage on a Jap carrier and battleship. Less than half of Bombing 241's pilots and gunners returned unharmed from the attack, but even then their task was not done. A fleet of them was sent out that night to finish off two enemy carriers reported afire 180 miles from Midway.

Col. Ira L. Kimes, commanding Marine Aircraft Group 22 to which the fighters and bombers belonged, said of the night mission:

"The night was pitch black, the target could not be found and only six bombers returned on schedule. They continued to return at intervals throughout the night with the assistance of blind luck, a defense battalion searchlight and the oil fire (caused by the Jap bombers which managed to evade Fighting 221 earlier in the day) on Sand Island."

Maj. Benjamin W. Norris, USMC, commander of one formation of Bombing 241, did not return from the night mission.

Marine aviation dates back only to 1912, when Lieut. A. A. "Ma" Cunningham became Naval Aviator No. 5 after learning to fly in a plane built by a Philadelphia inventor, but the record of the war in the Pacific to date contains ample proof that the Marine flyers are carrying on in a manner fully in keeping with the best traditions of the Corps.

What accounts for their splendid showing? Training and careful selection of the personnel are perhaps the most important factors, together with the fact that we are giving the flyers the best planes and guns that American engineering skill can produce. Last but certainly not least, the men who fly Marine Corps planes do so because they *want* to be Marines.

Strictly speaking, there is no such thing as a Marine aviator for they all are Navy-trained and before being commissioned in the Marine Corps, they are designated as Naval aviators. It is just prior to getting their wings at Navy flying schools that cadets are given the opportunity to choose between the Navy and Marine Corps.

The job the Marines have been doing in the Pacific certainly speaks for itself, but just to keep this discussion from getting too serious, here is an anecdote which may help Marines to keep that job in proper perspective:

Maj. W. L. J. Bayler, the last Marine officer to leave Wake Island before its defenders were overcome, was sent to Midway where he had charge of certain construction work. Later, he served throughout the campaign on Guadalcanal.

On his return to the West Coast recently, he was stopped by a motorcycle policeman because his automobile's headlights were violating the dimout regulations.

"Say," asked the policeman, "don't you know there's a war on?"

END

President's Flight

(*Continued from page 25*)

The tropical atmosphere, with only the hint of clouds, gave promise that the famous "Roosevelt weather" would hold throughout the trip. It was 1,600 miles from Miami to Port-of-Spain, Trinidad, over the green island stepping-stones that dot the Caribbean; 10 hours of flying through scattered clouds and moderate winds. An hour and a half after the take-off the sun peeped over the ocean rim, touching with gold the big wings, dark fuselage and purring engines of the "Presidential Special."

The accompanying plane, the *Atlantic Clipper*, under command of Capt. Richard W. Vinal, kept steady pace with the *Dixie Clipper*, but with plenty of "air-space" separating the two ships. Throughout the flight it was possible at all times for the two planes to maintain visible contact by day, supplemented by radio contact (making possible radio bearings by one plane on the other for relative position checks) by both day and night.

In the late afternoon the two ships glided into a landing at Port-of-Spain, Trinidad. The President had made himself completely at home in his compartment soon after leaving Miami. There was a double mattress on the bed for added comfort. Five roomy seats offered a choice for reading, napping, talking or watching the swiftly-changing land and sea panorama.

A true mariner, the President followed with interest the charts on which had been plotted the expected course of the Clipper. A number of times he would recognize some spot where in former years he had gone deep-sea fishing.

With Captain Cone at his shoulder to answer questions, the President tried his

hand at aerial navigation by directing the big Clipper over Haitian mountain ranges until they swung high above the now-ruined Citadel, famous in days now gone as the mountain stronghold of the Black Emperor Christophe.

Most of the time the President was too engrossed in official business to pay attention to exact location of the Clipper, but Capt. John McCrea, White House Naval aide who was one of the official party aboard the President's plane, spent considerable time on the flight deck. The captain's keen interest in the intricate and mathematical procedure of flying one of the big Boeings extended to nocturnal visits to the flying bridge at odd hours, and once Captain Cone was surprised on looking up to see Captain McCrea entering the flight deck door clad in pajamas.

The precautions taken to guard both the nature of the flight and the person of the President were evident at Trinidad. Naval guards were everywhere. While the big ships rested easily at their moorings mechanics swarmed over them, checking all mechanical equipment so that the planes would be in top notch shape for the take-off in the early dawn. For security reasons, the entire flight was planned leg by leg and it was not until reaching Trinidad that it became known that the next hop would be the 1,200 mile jump across the green jungles of the South American coast to Belem at the mouth of the Amazon.

An hour out of Belem the *Dixie Clipper* made the first of what were to be four crossings of the equator with the President aboard.

The next hop, it then was disclosed, would be the 2,400 mile transatlantic flight to Bathurst, on the coast of West Africa. So, after a three-hour check, the two planes roared off eastward at dusk to land 18 hours later across the ocean.

Standard Pan American Airways operating procedure was followed on all these hops—careful forecasts of wind and weather to be expected, mathematical computations for flight times at various flying levels, then the precise calculation of fuel requirements at the various available levels, and finally the selection by the Clipper captain of the most advantageous altitudes for each stage of the flight.

Throughout the flight the captain, at his desk in the rear of the flight deck, had constantly at hand the up-to-the-minute account of the route already flown as well as all forecasts as to conditions ahead. He consulted with crew members as to special sections of their reports on conditions, then made decisions as to course, altitude and so forth.

With the help of the now-famous "howgozit" curve, developed by Pan American Airways flight crews, Captain Cone in the *Dixie Clipper* and Captain Vinal in the accompanying *Atlantic Clipper* were able at all times during their important mission to calculate the exact progress of their flight so that a substantial gas reserve could be maintained at all times to meet any unexpected conditions that might arise.

By use of the "howgozit" curve it is possible to obtain a graphic comparison between the forecast in miles per gallon and actual miles per gallon made good on the flight. The miles per gallon curve is worked out by combining two other curves, the gallons-per-hour curve (i.e., gas consumption) and the miles-per-hour curve (ground speed made good).

The usual hour of turbulent weather that generally is expected from the tropical front over the Atlantic was fortunately lacking as the *Dixie Clipper* plowed through the night high above the grey Atlantic. For less than a dozen minutes the going was moderately rough, then there was smooth sailing until Bathurst was sighted "dead on the nose" the next afternoon.

At Bathurst the President and his party temporarily parted company with the Clippers to proceed to Casablanca by landplane. It was not until two weeks later that they again appeared. Long before then, both Clippers were completely serviced and ready for the return trip to the United States. Before midnight on January 27, the President and his party were again aboard the *Dixie Clipper,* winging their way westward through night skies with the memories of historic decisions at Casablanca to talk over. The take-off had been before midnight in order to allow several hours of daylight before the landing at Natal, Brazil, next day.

So perfectly did all planes making this flight maintain formation during the night that with the first rays of dawn Captain Cone was able to spot ahead and slightly above his own plane the landplane in which the official party had flown while actually in Africa. It had accompanied the two P.A.A. Clippers all through the night, flying most of the way within a few miles of the Clippers.

The only incident during either east- or west-bound flights was the temporary "loss" of a motor aboard the *Atlantic Clipper* during this leg of the journey. Captain Vinal's right inboard motor began to run rough about three hours out of Natal. The propeller was feathered and the rest of the flight in to Natal made without further incident. In order not to lose the time that might have been necessitated by adjustments to the *Atlantic's* engine, another Clipper was substituted on the spot to which the passengers and crew transferred and proceeded on to Miami without a hitch.

At Natal the President spent the remainder of that day and the following night in the city and during that time visited with President Vargas of Brazil. Next morning he and his party again boarded a landplane for a daylight coastal flight to Trinidad, while the Clippers kept close pace. After a night in Trinidad, the Clippers were again boarded for a daylight flight to Miami, last leg of the portentous air journey.

So ideal were flying conditions and so perfect the day that Captain Vinal's plane appeared to those aboard the *Dixie Clipper* to be actually "glued to the tail" of the lead plane, although (as safety regulations provide) more than half a mile separated the two ships.

It was during this leg of the trip that

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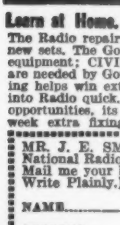

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[While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.]

"Passenger No. 1" enjoyed his first birthday party while in the air. Shortly after noon the birthday party got under way. It was a five-course dinner, complete to birthday cake with candles, and the President cut it himself while the guests joined in "Happy Birthday to you, Mr. President."

In honor of the occasion Captain Cone entered the following log of the final leg of the flight in red pencil under the heading "President's Birthday":

SPA-MIA: [1] 1-30-43
Take-off—1111 [2]
Track—314°
Distance—1633 [3]
Weather—Partly cloudy
Wind—SE to NE 15 kts.
Landing—2035
Gas load—3800
Reserve—8 hrs.
Air time—9.24
Latitude—(SPA) 10-40 N—Longitude 61-30 W
Latitude—(MIA) 25-44 N—Longitude 80-14 W

The roster of those in the President's party aboard the *Dixie Clipper* looked like a Who's Who in Official Washington. In addition to President Roosevelt, those making the eastbound trip were Harry Hopkins, Adm. William D. Leahy (as far as Trinidad), Adm. Ross T. McIntire, Capt. John L. McCrea, three Secret Service men, and Arthur S. Prettyman, the President's valet. On the return flight, Lieut. George A. Fox and A. C. Black, chief photographer—both of whom had been on the *Atlantic Clipper* for the flight to Africa—joined the official party aboard the *Dixie Clipper*.

Despite the high importance of the passengers and trip itself, the crews for the two Clippers were selected in the manner usual to all Clipper-flight assignments, that is, just as their names came up on the crew roster.

"Any one of a hundred P.A.A. crewmen could have been assigned to the trip with as much assurance of success," Captain Cone insists.

Cone is a former Navy pilot. To the Pensacola-trained captain fell the honor of carrying the first President of the United States to fly while in office. Cone saw active duty with the carrier *Saratoga* of the Pacific Fleet, flying a utility plane as an ensign, USNR. That was followed by assignment to a scouting squadron operating out of San Diego. When he joined Pan American in February, 1934, he was stationed first in Miami, later served with the transpacific division, and then flew extensively in South America before coming with the Atlantic division in April, 1941.

In business clothes he might pass for a college mathematics professor, and when he talks it's with that soft drawl that hints that Arkansas was his birthplace. Like the old sailing-ship Clipper captains of former years, this 20th century flying skipper has the keen eyes of a voyager to far places. We noticed that when we talked with him high in the tower of a Manhattan skyscraper. It's a good seven miles from the office where we sat to La Guardia airport, but the captain happening to glance in that direction caught instantly the swift-moving speck that was an airplane taxiing for a take-off from the field.

He is something of an aviation inventor and writer himself. He helped perfect a direction finder trainer that has attracted official notice and last year wrote an article entitled "The Technique of Flying in Rough Air," based on his experience in handling the big flying boats.

END

[1] Port-of-Spain, and Miami.
[2] All times are Greenwich Civil Time.
[3] Statute miles.

At Deadline

(*Continued from page* 14)

background material dealing primarily with the Army. We've attended meetings where everyone agreed on any number of "things" our part of the CAP could do—if headquarters would only cooperate. But so far, we don't feel that we've been able to do a single worthwhile job, because nobody ever has given us a worthwhile job to do.

* * *

FIRST time we tried for "The President's Flight" (page 25) we were turned down cold. All the pilots, both TWA and Pan American, were willing—but the Army turned thumbs down. That took place in a Washington conference. Mr. Murdoch spent that week-end just before this issue went to press talking with Captain Cone and his Pan Am crew in New York. Monday—four days before press time—the article arrived. It would have been too simple to have that problem end there. We found that the article still had to go through Army for clearance. A hurried copy was made and shot off air mail to Washington. The original went to the printer with orders to set it "as is" and hope for the best. We spent two days waiting, waiting . . . Then, the evening before this issue went to press, a long distance phone call. They'd gone over it carefully, the major said, and decided there were no objections!

* * *

We nearly fainted. MAX KARANT.

END

I Learned About . . .

(*Continued from page* 68)

up the engine, until it slipped down over the control wires on one side and there had flapped back in the slipstream, beating a devil's tattoo against the under surface of the horizontal stabilizer and flipper hinge. The heavy metal buckle had been banging away with hefty wallops as I climbed and circled the field. Already, in one circuit of the airport, it had driven a deep dent in the metal framework and had I flown much longer the buckle could well have destroyed the functioning of the elevator, with disastrous results.

I learned about flying from that, and never since have failed to check on any untoward performance of my plane however insignificant. If I cannot determine the cause, I land and find out.

END

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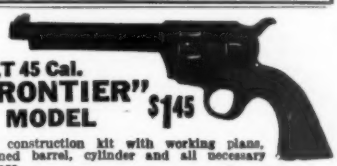

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Iceland Flight

(*Continued from page 70*)

Command men might rather be in bed.

For it's a long day they put in, and in surroundings anything but cheerful.

You see nothing but soldiers — the American troops stationed there—or sailors, passing through, and there's little entertainment to be had. The Icelandic girls, although beautiful nordic types, keep pretty much to themselves. You can watch a movie in your Army camp, or see one in Reykjavik, but that's about all.

The Icelanders themselves are prospering as never before because of the presence of the American troops and are having a fine time riding around in shiny new cars on good new American-made roads, but it's pretty bleak for the soldiers and the men of the ATC.

And this is the life for which the ATC men's reward is an Army captain's pay, or something like a fourth of what they used to make on the civilian airlines.

Two of the Ferry Command men in Iceland with whom I talked were Capt. E. W. Chatfield, of Peach Orchard, Ky., later of Chicago, New York, Dallas and Ft. Worth; and Capt. C. H. Jeeter, of Elk City, Kans., who got his college training at Oklahoma A. & M.

It was Jeeter who typified the way the shut-in trio felt when a plane bound for England arrived with the pilot suffering from pneumonia.

Rushing the flyer into the hospital, Jeeter, although he'd never flown that particular type of plane before, jumped at the chance of a night in London for a change, and flew it the rest of the way across the ocean himself.

Another illustration of the monotonous life these men of the ATC voluntarily live occurred the night before I left Iceland.

I was already asleep, lulled into slumber by the heat of the old pot-bellied stove in the center of the little, domed hut, when Chatfield came bouncing in around 9 o'clock.

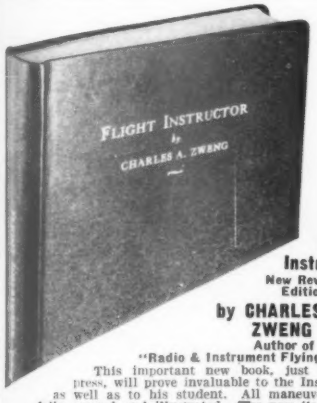
"Look here," he shouted. "That plane that just came in had the rest of my winter equipment on it."

He fingered a sheepskin-lined coat and exhibited a new pair of heavy boots and a fur-lined helmet.

"By all the odds," he said triumphantly, "don't you know what this might mean? This might mean that now I've got just what I need to get through the Icelandic winter, I'll probably be transferred to Cairo."

They'd give anything for a change, the ATC men, but if it's not in the cards for them you'll find them at their posts anyway, doing a real job that may be less exciting than flying a fighter plane but which calls for courage and stamina nonetheless.

END



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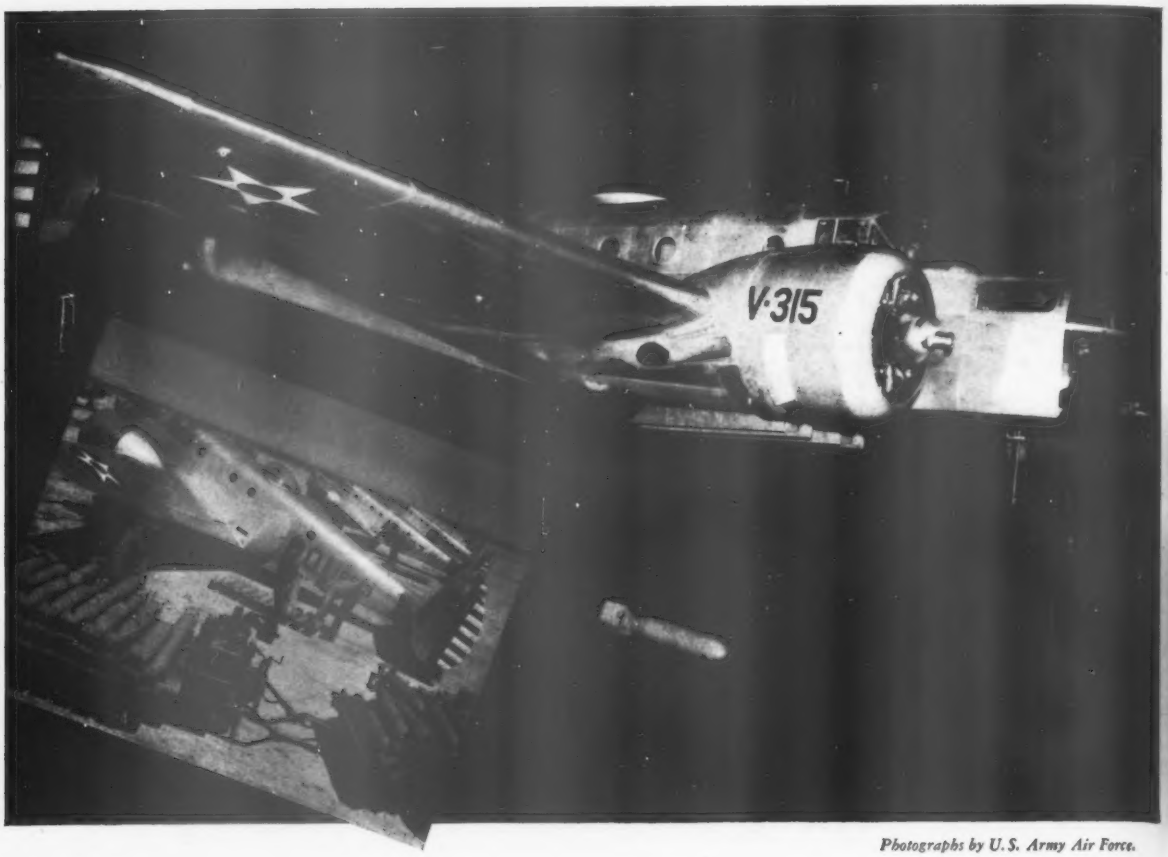

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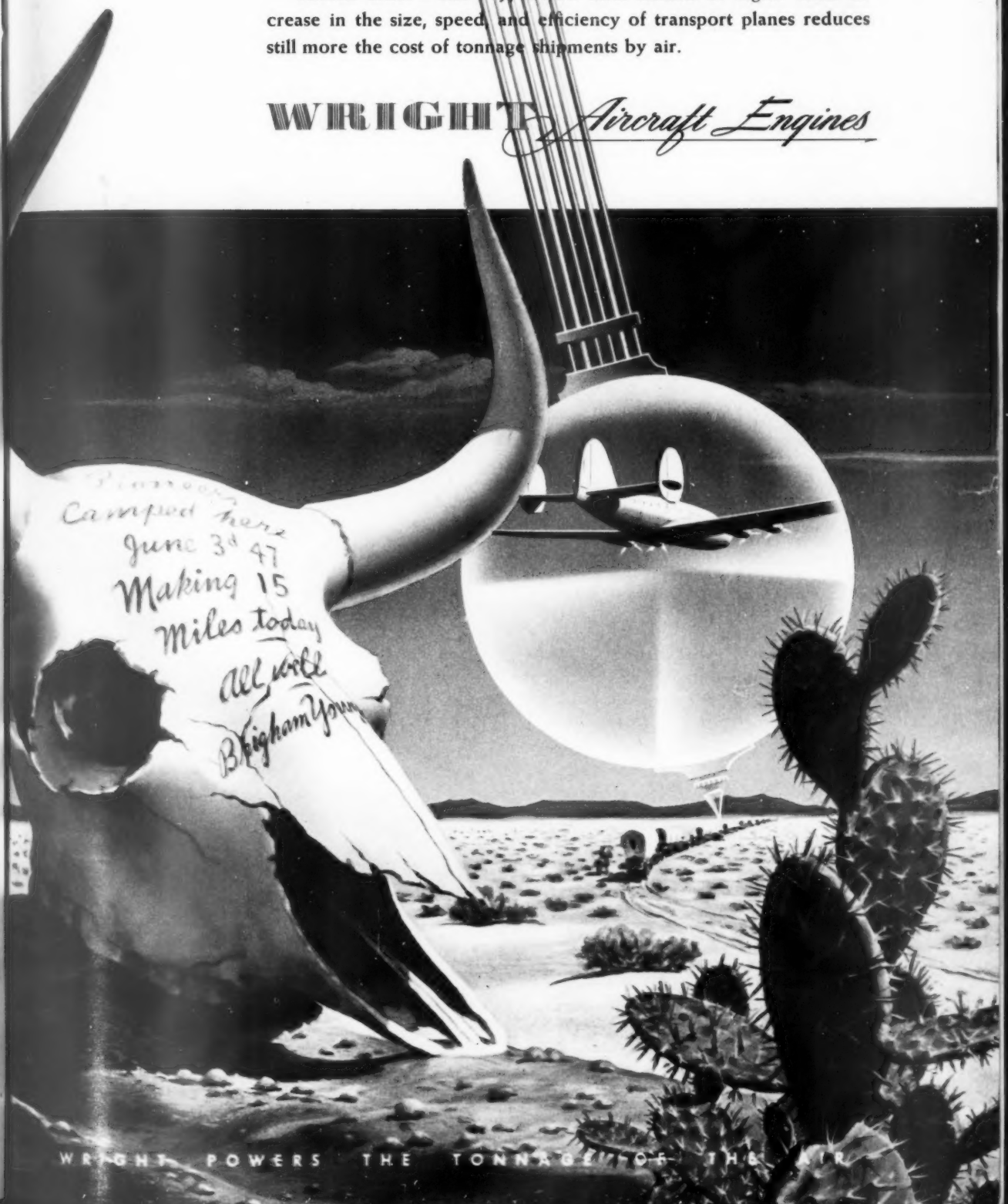

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